CMI
19-549C

FORESTRY ABSTRACTS

VOLUME IX. 1947-48

Published by the
IMPERIAL FORESTRY BUREAU
OXFORD
1948

Printed in Great Britain at the Works of
W. HEFFER & SONS, LTD., CAMBRIDGE, ENGLAND

FORESTRY ABSTRACTS

VOLUME 9 1947 NUMBER 1

EDITORIAL NOTE

To meet the needs of those who wish to ledger-file their *Forestry Abstracts*, a small number of One Side Only copies has been printed, starting with Vol. 8 (4). These are obtainable from the Central Sales Branch, Aberystwyth at the same price as ordinary copies. If the demand justifies, One Side Only copies of the separate issue of Section 3 may be printed also in future.

In accordance with the wishes of the Empire Forest Conference, the practice of issuing Section 3 of *Forestry Abstracts* concurrently as an extra impression, under the title "Forest Products and Utilization", is being continued.

FORESTS AND WATERCATCHMENTS, WITH SPECIAL REFERENCE TO THE NORTH TEMPERATE ZONE

MAN, the great destroyer of forests, is coming by hard experience to value them for much more than their solid produce. The 'hewer of wood and drawer of water' has in most places overhewn his wood and then found that he has overdrawn—or at least dissipated—his water as well. From such basic shortage, much experimentation has been born all over the world; experimentation that seeks to discover how not only tree growth but vegetation as a whole is related to water conservation. A survey of the literature to date, in the forestry field alone, shows the matter to be both complex and controversial, and it is clear that much more basic research must be done before specific questions can be answered with certainty. Forests, moreover, grow in such a vast variety of habitats that results established for one set of climatic and edaphic conditions may by no means hold for a different set of conditions, so that caution is needed in drawing general conclusions from single experiments. Two classic investigations, one in the Sperbel- and Rappengraben in Switzerland [1], the other at Wagon Wheel Gap, Colorado [2] were both sited in high mountainous country; while many studies, e.g. in Russia, are concerned with regions where snow forms the major part of the annual precipitation.

This résumé refers chiefly to north temperate conditions and summarizes the findings under certain major heads—

Forest influence on local rainfall: There now seems general agreement that forests have no appreciable influence on precipitation associated with such large-scale phenomena as cyclones or monsoons. Some evidence from India and Africa indicates that, where meteorological conditions favour the production of 'instability rain', the frequency and amount of such rain is greatly increased by the presence of forests. There is also some evidence, any total increase apart, that forests may cause the rainfall to be spread more evenly throughout the year [3]. It does, however, seem fairly certain that condensation of mist (occult precipitation) is increased in forests; experiments have shown that total precipitation in German Spruce forests is appreciably greater than in adjacent open country during months with many misty days, while the effect is reversed during months with few [4]. In East Africa mountain forests have been calculated to induce occult precipitation up to at least 25 per cent. of the annual rainfall. Parallel findings come from Japan [5] and the Oregon Coast [6]. It is well established that the microclimate of a forest differs from the climate of the surrounding open country; as a broad generalization, both the absolute and relative humidity of the air are greater and the temperature—save at night and in winter—somewhat lower [3, 7, 8], while wind movements and evaporation are much reduced.

The factors involved here are numerous, often complexly interactive (hence difficult of individual assessment and control) and also highly variable for site. Both direct (hydrometric) and indirect (analytic) studies of whole catchment areas, measuring adequately every material factor in play and over a considerable period of years, seem called for, covering, moreover, a typical range of sites and having adequate replication. In view of the money, time and skilled staff required, such comprehensive studies have so far been few, and each has furnished lessons for future work. On two small catchments near Wagon Wheel Gap, Colorado [2], measurements were taken of stream-flow, precipitation, sediment, and other factors for a period of 8 years. Then one of the catchments was denuded of woody vegetation and records were continued for another 7 years. As a result the average annual water yield increased 15 per cent., spring yields (from snow) 22 per cent.; but measured sedimentation also rose from almost none to about 1·3 cu. yds. per year.

In the classic parallel investigation in Switzerland [1]—now in its fifth decade—the 30 per cent. wooded and 70 per cent. predominantly pastoral catchment area of Rappengraben likewise released much higher water yields than the 99 per cent. wooded Sperbelgraben during periods of heavy rain and snowmelt, but less during pronounced drought; and averaged 70 per cent. more loss of soil-detritus over a 36-year period.

Evaluation and comparison of results such as these must take into account many local factors of varying potency. Thus the Colorado experiments were with open forest of Aspen (*P. tremuloides*) standing on deep, porous soil with moderate gradients and only 21 in. annual precipitation, half of it snow; and the cleared forest quickly coppiced. The Swiss experiments concerned well-stocked predominantly coniferous forest, a much less permeable soil, steeper gradients and 66 in. to 68 in. annual rainfall; and the area under comparison was two-thirds pastoral. The frequency, duration and season of intense precipitation and of hot, dry spells, and the underlying rock structure are other important factors.

On the analytic side, which studies the terms in the rough hydrological equation—

Precipitation minus vegetational offset = water discharge

or

[Total rain + snow fall] − [interception + transpiration] = absorption + runoff, numerous experiments combine to a fairly consistent, if complex, picture. Only certain salient references can be given here.

Loss by Interception: (*a*) Aerial: Investigations by Ney (Germany), Bühler (Switzerland), Matheau (France) and others show that tree crowns hold up and evaporate much more precipitation than does grass or other low vegetation, the amount varying greatly with the kind of forest and the intensity of the rain; evergreen forest claims more than deciduous, year by year, and intermittent light rains lose more to the canopy than prolonged heavy rains. Average losses are estimated to range from 39 per cent. of the annual precipitation for Spruce down to 13 per cent. for deciduous forest, with the difference between conifer and broadleaf dwindling to 10 per cent. in summer. Russian findings for six types of forest are closely parallel—Spruce 28–37 per cent., Pine 25 per cent., Oak 15–22 per cent. [9]; Swedish, for Spruce only, over 50 per cent. [10].

(*b*) Ground: Numerous experiments in Europe and elsewhere have demonstrated that evaporation from forest floors is only ½ to ¼ that from soils outside. Ebermeyer, working in summer with soils kept saturated, found that evaporation from forest soil with litter was 15·4 per cent. and without litter 39 per cent. of the amount evaporated from similar soil in the open. In Trinidad, with tropical rain forest, ratios were much the same. Nevertheless, the amounts evaporated are substantial, totalling up to 30 per cent. of the annual precipitation.

In general terms, then, forests evaporate much more rainfall from the canopy and much less from the floor than other forms of vegetation, the denser the stand the sharper the respective contrasts. The special case of snow has received much attention from investigators, notably in Russia and the U.S.A. Russian work has shown that snow lies longer and thaws more slowly in forest than in the open; the forest often does not begin to thaw until the open country is clear of snow. The result of this in well-wooded country is greatly to reduce spring floods [11, 12]. Mature broadleaved forests hold the maximum reserve of snow. Compared with hardwoods, Pine and Spruce hold respectively 10–20 per cent. and 30–50 per cent. less in hard winters and up to 70 per cent. less in winters with

frequent thaws [13]. In Colorado under very different conditions of climate, topography and soil, snow storage was found to be greater under Aspen (10·9 in. of water) than in the open (9·6 in.) or under dense young Pine (8·4 in.); while various intensities of selective cutting in mature Lodgepole Pine (*P. contorta*) showed an increase in storage with heavier cuts, and almost co-terminous melting [14].

Transpiration: Researches on the water requirement of trees, whatever the method of approach, show that this varies greatly both for species and the individuals of a species, according to such factors as age, vigour and edaphic and climatic conditions. Generalization for tree communities or forests, even when growing pure and in a restricted locality, have, therefore, to be accepted with caution and await the results of further research. The indications, at least for temperate conditions, are that the water loss from this source is not of the same order as the evaporation loss. Höhnel estimated that out of a yearly rainfall of 31·5, Pine absorbed 3·1, Spruce 9·1 and Beech 10·8, average 7·7 in. or 24 per cent. of the total rain. Agricultural determinations by Hellriegel (*Grundlagen der Landwirtschaft*) of the water necessary for each species of plant to produce a given quantity of dry matter, if applied to forest growth, indicate that the 'relative water consumption' of trees is roughly half that of field crops; but the absolute consumption may be much more owing to the greater mass of closed high forest and the deeper, more pervasive root systems which can draw on moisture not available to other forms of vegetation. There is some evidence that in level country with horizontal geological strata, forests may bring about a lowering of the subterranean water level, as they draw moisture from a greater depth than do other forms of vegetation. Work at the Sopron Research Station, Hungary, in connexion with waste-land reclamation in the plains of the Danube and Tisza Rivers showed that the forests of the plain usually lower the ground-water table except in years of abundant rainfall and in the case of tree species of feeble transpiration, such as *Robinia*. The depth at which ground water ceases to be a factor in tree nutrition depends on local conditions and particularly on root depth. In most cases ground water becomes inactive below 6–7 m., as tree roots rarely go deeper than 4 m., while the maximum capillary rise of water is 2–3 m. [15]. Again, investigations at the Trostyanetsk forest experiment station [12] in steppe conditions, showed that on a sandy soil and subsoil, and on 'suglinok' (sand and clay) soils, forest uses considerably greater amounts of moisture than does herbaceous vegetation, and thus reduces both soil/sub-soil moisture and ground water.

From the foregoing it appears that the combined forest claim on the rain falling on it, through its physical interception and evaporation, plus its organic needs, must be subject to very wide variation, but will frequently exceed 50 per cent. Höhnel's investigations gave 49 per cent. for Pine, 61 for Beech and 76 for Spruce, out of 31·5 in. annual rainfall; average 62 per cent. Woolny and Rielser found 62 per cent. also as the corresponding average for field crops, which compares with about 50 per cent. evaporation from bare soil in the open. Generally speaking, therefore, forests and field crops would seem to diminish equally, though in somewhat different fashion, the total volume of water available to streams; and to diminish it rather more than bare open ground.

Absorption and runoff: The rôle of forest cover in ensuring optimum storage capacity in every type of soil has been the subject of worldwide research, employing a variety of approaches and techniques. Innumerable experiments in different countries have established the superior permeability of forest soils compared with soils in the open and particularly with pasture. In Ohio, on silt loam, the infiltration rate under a 60-year-old Pine stand was 7 times that on exactly similar but unforested old field nearby; and in Pine plantations varying in age from 12 to 59 years, more than 13 times that of adjacent cultivated fields. The Soil Conservation Service Experiment Station at Coshocton, Ohio, found that over a period of one year, forested land admitted 6 in. more water to the deep soil than did cultivated fields [16]. Recent tests in the Sperbel- Rappengraben experiments already mentioned, showed that good forest soil absorbed 100 m. precipitation in 1–2 minutes, whereas hard pasture soil took 1–5 hours. A 50 mm. precipitation in 50 minutes caused no measurable runoff from the forest soil but 60 per cent. runoff from the pasture [1]. This relatively greater permeability of forest soils is much more pronounced during short periods, or in the early stage, of rainfall. In experiments at Istrinsk in medium and strongly podzolized soils, initial absorption in mm. for the first hour was 136 under forest, clover 110, arable, 86, meadow pasture 53, but later the rate fell to an average of only 4·5 $\pm$ 0·56 mm. per $\frac{1}{2}$ hour with no marked difference due to type of land use [17].

Several writers have also pointed out, while admitting the superior absorptiveness of forest soils, that all catchment areas have a certain maximum storage capacity which varies with the underlying geological structure as well as with the infiltration capacity of the soil. Water in excess of this maximum will contribute to floods whether forest is present or not; hence in assessing the value of forests in flood control, the local geology and intrinsic soil conditions must be taken into account [18]. The protection afforded by forest cover is greatest on clay soils, particularly those with a high content of clay of colloidal fineness, which are especially subject to erosion, and much less absorptive than sands and loams [19].

As regards differences due to forest species, Russian experiments in the Obolensk region with 5 comparable stands of pure Birch, Larch, Oak, Lime and Spruce showed the soil under Oak to have the highest absorption capacity and Lime almost as high; with short-lived rain, Birch had the lowest capacity and Larch about as high capacity as Lime. With prolonged rain Spruce had the lowest of all. Undergrowth did not affect the rate of absorption in summer but raised it in spring, thereby considerably weakening the spring flow [20].

The precise rôle of litter in the absorption process is still under investigation. But it appears important. Russian researches have shown that the water-absorbing capacity of forest soil with litter was 2 to 4 times as great as that of similar soils with the litter removed; and that litter from deciduous trees was more absorptive than needle litter [21]. Lowdermilk, using artificial rain and also a special 'tank' technique, demonstrated the special value of litter in filtering muddy water and so keeping the soil pore space clear. He also found that under a total of 190 in. of rain, runoff from surfaces of 30 per cent. gradient cleared of litter by burning was 3–30 times that from litter-covered surfaces, according to type of soil and intensity of rain, results important for high-rainfall mountain country. But removing the litter by burning may produce secondary effects. Experiments in the Missouri Ozarks showed a marked reduction in the water intake of 7 different types of soil following annual burning of the forest cover for 5 or 6 years; the difference in infiltration rates of burned and unburned conditions varied from 20 to 62 per cent. for different soil types, but was highly significant in all cases. Out of an average reduction of 38 per cent. only 18 per cent. could be attributed to actual loss of litter [22].

All these factors in the water economy of the forest, so intimately linked with its vital processes and effects, operate, research has demonstrated, with very varied potencies in the wide diversity of conditions supporting tree growth over the earth's surface. It is in the light of these varying potencies, and the equally varied results of their interplay, that controversy about the forest's 'water value' should be viewed [23–25]. Where, in the hydrological equation, **P**, Precipitation, is high and of intense phase type, the trees' off-take, viz. **I**nterception + **T**ranspiration tends to lessen, relatively if not absolutely, and the **A**bsorption to **R**unoff ratio becomes important, especially on steep profiles and in any case where the soil mantle has intrinsically poor infiltration capacity. On the other hand, where **P** is moderate to low and of mild phase type, **I** and **T** tend to rise, particularly in warmer climates, and may reduce **A** and **R** to the prejudice of human welfare in regions where the **A** : **R** ratio carries no erosion menace [1, 2; 14, 26, 27].

F. R.

REFERENCES

[1] BURGER, H. 1943. Einfluss des Waldes auf den Stand der Gewässer. III. Der Wasserhaushalt im Sperbel- und Rappengraben von 1927/1928 bis 1941/1942. *Mitt. schweiz. Anst. forstl. Versuchsw.* 23 (167–222). [Cf. *For. Abstr.* 6 (122).]

[2] BATES, C. G. and HENRY, A. J. 1928. Forest and streamflow experiment at Wagon Wheel Gap, Colorado. *Missouri Weather Review*, Supplement No. 30.

[3] TROUP, R. S. 1940. Colonial Forest Administration (Chap. IV and App. I). Oxford University Press.

[4] SCHUBERT, J. 1942. Nebel und Niederschlagsmenge im Fichtenbestande und im Freien. *Forstarchiv* 18 (10–11). [*For. Abstr.* 4 (14).]

[5] HIRATA, T. 1929. Contribution to the problem of the relation between the forest and water in Japan. Imp. For. Exp. Sta., Meguro, Tokyo.

[6] ISAAC, L. A. 1946. Fog drip and rain interception in coastal forests. *For. Res. Notes Pacif. Nthwest. For. Range Exp. Sta.* No. 34 (15–16). [*For. Abstr.* 9 (2), in preparation.]

[7] GEIGER, R. 1941. Das Standortsklima in Altholznähe. *Forstarchiv* 17 (316–7). [*For. Abstr.* 4 (p. 13).]

[8] PETROVSKI, Yu. S. 1940. Temperatura i vlazhnost' vozdukha v lesonasazhdeniyakh. [The temperature and moisture of the åir inside forests.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 18 (247–67). [*For. Abstr.* 7 (No. 551).]

[9] LUCHSHEV, A. A. 1940. Osadki pod pologom lesa. [Precipitation under the forest canopy.] *Trud. vsesoyuz nauchno-issledov. Inst. lesnogo Khoz.* No. 18 (113–48). [*For. Abstr.* 7 (No. 571).]

[10] STÅLFELT, M. G. 1944. Granens vattenförbrukning och dess inverkan på vattenomsättningen i marken. [The water consumption of Spruce and its influence on the water régime of the soil.] *K. LantbrAkad. Tidskr.* 83 (425–505). [*For. Abstr.* 7 (No. 566).]

[11] MURASHEV, S. I. and KUZNETSOVA, Z. I. 1939. Vliyanie sostava, vozrasta i polnotȳ nasazhdeni na snegovoy rezhim. [Influence of composition, age and density of stands on the snow régime.] *Trud. vsesoyuz. nauchnoissledov. Inst. lesnogo Khoz.* No. 8 (27–44). [*For. Abstr.* 7 (No. 1059).]

[12] GOTSHALK, Yu. F. 1939. Dannȳe o gidrologicheskoy roli nasazhdenii v raione Trostyanetkoy lesnoy opȳtnoy stantsii. [Data on the hydrological rôle of stands in the vicinity of the Trostyanetsk forest experiment station.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8 (229–52). [*For. Abstr.* 7 (No. 1061).]

[13] RUTKOVSKI, V. I. 1940. Vliyanie nasazhdeni na snegovoy rezhim. [Influence of stands on the snow régime.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 18 (18 (149–79). [*For. Abstr.* 7 (No. 568).]

[14] Rocky Mountain Forest and Range Experiment Station. 8th Annual Report. 1943.

[15] SCHAEFFER, L. 1939. Nappe phréatique et végétation forestière. [The water table and forest vegetation.] *Rev. Eaux For.* 77 (130–41). [*For. Abstr.* I (78).]

[16] Michigan's Water Problems: Water Conservation Conference Jan. 28, 1944. [*For. Abstr.* 8 (No. 69).]

[17] SOZȲKIN, N. F. 1941. Opredelenie vodopronitsaemosti i vlagoemkosti lesnȳkh pochv. [Determination of the permeability to water and the moisture capacity of forest soils.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo. Khoz.* No. 24 (161–92). [*For. Abstr.* 7 (No. 1565).]

[18] BATES, C. G. 1938. Reforestation and flood control. *J. For.* 36 (1073–9).

[19] ASHE, W. W. 1925. Protection of public water supply by forest cover. *J. Amer. Water Wks. Ass.* 13 (404–9).

[20] SOZȲKIN, N. F. 1939. Gidrologicheskoe znachenie lesnoy podstilki i fizicheskikh svoystv lesnȳkh pochv. [Hydrological significance of forest litter and the physical properties of forest soils.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8 (125–205). [*For. Abstr.* 7 (No. 1060).]

[21] KHARITONOV, G. A. 1940. Vliyanie sostava nasazhdeni na vodopogloshchenie. [Influence of the composition of the stand on the absorption of water by the soil.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 18 (181–95). [*For. Abstr.* 7 (No. 569).]

[22] AREND, J. L. 1941. Infiltration rates of forest soils in the Missouri Ozarks as affected by woods burning and litter removal. *J. For.* 39 (726–8). [*For. Abstr.* 3 (198).]

[23] WILM, H. G. 1946. The status of watershed management concepts. *J. For.* 44 (968–71). [*For. Abstr.* 8 (No. 2271).]

[24] WOOD, G. L. 1928. Australian forests in relation to climate and erosion. *Aust. For. J.* 11 (131–8).

[25] Report of the Committee on Forests in relation to Climate, Water Conservation and Erosion. Fourth Emp. For. Conf. 1935.

[26] DUNFORD, E. G. 1944. Proper timber cutting increases supply of irrigation water from mountain slopes. *Colo. Fm. Bull.* 6 (10–12). [*For. Abstr.* 6 (216).]

[27] STAPLES, R. R. 1936. Vegetation types and water supplies. *E. Afr. Agric. J.* 1 (453–5).

[28] BÜSGEN, M., and MÜNCH, E. 1929. The Structure and Life of Forest Trees. 3rd ed., translated by T. Thomson. Chapman and Hall, London.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. BIBLIOGRAPHY. MATHEMATICAL AND STATISTICAL ANALYSIS

[1]. 01.6 (47.1). Suomen Metsätieteellisen Seuran julkaisusarjojen sisällysluettelo. [**Indexes to the publications of the Finnish Forestry Society.**] *Silva fennica* No. 62, 1946. pp. 68. [Covering *Acta forestalia fennica* 1–50 (1909–42), *Silva fennica* 1–60 (1926–43), *Commentationes forestales* 1–6 (1928–33).]

[2]. 01.7. ANDERSON, R. L., and HOUSEMAN, E. E. **Tables of orthogonal polynomial values extended to N = 104.** *Res. Bull. Ia. agric. Exp. Sta.* No. 297, 1942 (595–672).

[3]. 01.7 : 02.1. MATHER, K. **Statistical analysis in biology.** Methuen & Co., Ltd., 36 Essex Street, Strand, London, W.C.2. 2nd ed. (revised and enlarged) 1946. pp. 267. [John Innes Horticultural Institution, London.]

02. DICTIONARIES

[4]. 02.4. GARCIA-PIQUERA, C. **A Spanish-English glossary of forestry terminology. II.** *Carib. For.* 8 (1), 1947 (45–64).
Cf. *For. Abstr.* 8 (No. 826).

04. MAPS. PHOTOGRAPHY

[5]. 04.4 (71.3) : 12.19 : 11.62 : 61.32 : 94 : 91 : 43.12 : 33.17 : 33.32 : 97.5. **Ontario forest atlas.** Department of Lands and Forests, Toronto, Ontario. [1945?] 15 maps.

Includes maps showing geological formations, principal catchment areas, areas photographed by aerial surveys, lands open for settlement, provincial forests, forest regions and districts for administrative purposes, fire-detection lookout towers, pulpwood concessions, pulp, paper and saw mills, geographic range of native tree species.

[6]. 04.5 : 61.32 : 12.11.1 : 12.14.5 : 41 : 31.1. CLARK, W. **Photography by infra-red: its principles and applications.** John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., London. 2nd ed., 1946. pp. xvii + 472. Price $6.00 (36s.)

The second edition of this book has been thoroughly revised to include the great progress made with infra-red films, which are now as stable as panchromatic films. The special applications of infra-red photography have received much attention, and some are of interest to forestry.

Different types of foliage photograph differently in the infra-red. Deciduous vegetation in general reflects well while evergreens are poor reflectors. For forest-type mapping, infra-red photographs are definitely superior to panchromatic photographs. The tone differentiation given by the yellow No. 12 filter is generally sufficient and the pictures are more readily intelligible to the untrained observer. Hardwoods can be distinguished from softwoods in probably all forest regions. Some species of North American conifers can be distinguished from one another on the basis of tone, which ranges from black for Red Pine, Western Yellow Pine and Scots Pine, through dark greys for Spruces and White Pine, to light grey for Hemlock and Larches. But old individuals appear darker than young ones of the same species, e.g. very young White Pine is so light that it may be confused with hardwoods, and old White Pine photographs nearly as black as Red Pine. Allowance also must be made

for the angle of the sun and for shadows. Broadleaved species and grass are rendered white or very light and separation of species is rarely possible. For open grassland with deciduous growth infra-red is of little value if detailed identification is desired. Defoliated and dying trees appear black in infra-red photographs, the effect being due to the exposure of the forest floor below; defoliation is, however, just as obvious on panchromatic photographs. The limit of the useful range in ecological work is about 10 miles; timberlines may be detected at 50 miles on mountain ranges, but, e.g. Aspen patches in Spruce-Fir forests at the same ranges have not been detected. As a means of studying and diagnosing plant diseases in which there is a change in the pigment or cellulose material, infra-red photography should be useful. Where the chlorophyll or other constituents of leaf cells are destroyed by disease or by drying or burning, the damaged areas show up darker.

Wood varies considerably in its transparency to infra-red rays, e.g. the permeable thickness varies from 0·5 mm. in Walnut to 6–7 mm. in Silver Fir; at 3 mm. thickness there is some transmission of infra-red through Teak, Mahogany and Jarrah, and more through Iroko, Ebony and Indian Silver-grey wood.

06. CONFERENCES. EXHIBITIONS. PROPAGANDA

See also *For. Abstr.* 9 (No. 350).

[7]. 06.2 (410) : 05.3. GREAT BRITAIN. **Imperial Agricultural Bureaux Conference: report of proceedings.** H.M. Stationery Office, London. 1946. pp. 71. *Cmd.* 6971.

[8]. 06.2 (54) : 2. GRIFFITH, A. L. **The seventh All-India Silvicultural Conference (Dehra Dun, October 28th to November 6th, 1946).** *Indian For.* 73 (1), 1947 (16–30 + plate).

A list of resolutions adopted by the conference on the subjects:—(1) organization of post-war silvicultural research; (2) organization of ledger filing; (3) afforestation of dry and desert areas; (4) the contour principle in counter-erosion measures; (5) farm forestry; (6) the technique of soil-erosion surveys; (7) the efficiency of enumerations; (8) pasture and fodder; (9) seed collection, distribution, storage, testing and transport; (10) soil problems; (11) restocking over-exploited areas; (12) the effect of burning and other accessory operations upon the soil as affecting artificial regeneration; (13) irrigated plantations; (14) *Casuarina equisetifolia* plantation technique; (15) thinning research; and (16) publications.

The eighth All-India Silvicultural Conference should be held in 1951.

[9]. 06.2 (7 : 8). TORTORELLI, L. A. **Resoluciones forestales de la IIIª Conferencia Interamericana de Agricultura reunida en Caracas.** [Resolutions on forestry adopted by the Third Inter-American Conference on Agriculture held at Caracas.] *Publ. tec. Direcc. for. Argentina* No. 6, 1946. pp. 12. [Span.]

[10]. 06.2 (73) : 90. UNITED STATES. **Proceedings of the American Forest Congress, October 9, 10 and 11, 1946.** American Forestry Association, Washington, D.C. 1947. pp. 379.

[11]. 06.6. TORDOFF, H. **Forestry publicity through display.** *Carib. For.* 8 (2), 1947 (83–90). [E.Span.f.]

Describes a plan for making known to the public, by means of displays, the work of the Trinidad Forest Department. A series of panels in wall cases, one for each forest type, present graphically the structure and composition of each important forest type, its main habitat factors, the aims and methods of its management, and their results. The plan of a specimen panel is shown.

07. EDUCATION AND RESEARCH

See also *For. Abstr.* 9 (Nos. 263–4, 348).

[12]. 07.1 (485). PERSSON, E. Skogsvårdsgårdarnas betydelse för skogsvårdsstyrelsernas upplysningsarbete. **[The rôle of the forest-conservation estates of the Swedish County Forestry Boards in the educational work of the latter.]** *Från skogsvårdsstyrelsernas arbetsfält* pp. 57–70. [Sw.] *Suppl.* to *Svenska SkogsvFören. Tidskr.* 45 (1), 1947.

[13]. 07.1 (71.4). ROUSSEAU, L. Z. **Forest education in Quebec.** *For. Chron.* 22 (4), 1946 (246–9). [Laval Univ., Quebec, P.Q.]

[14]. 07.1 (73). VITAS, G. **American forestry schools must come out swinging.** *J. For.* 45 (3), 1947 (159–71).

The writer discusses the future of the forestry profession in the United States, the prospects of employment for the unprecedented number of students now enrolled at the forestry schools, and the desirable changes in curriculum and outlook of those schools if they are to fit the students for employment. He stresses the necessity for adapting forestry education to the training of practitioners in farm forestry, public relations, business administration, marketing, consultant forestry, surveying, housing construction, real-estate dealing, commercial nurseries, tree surgery, sawmilling, etc. It is essential that the teaching staff should be in continuous touch with practical forestry, business, etc.

[15]. 07.1 (73). STODDARD, C. H. **Some observations on forest education.** *J. For.* 45 (3), 1947 (172–3).

A plea for more instruction in scientific method, encouragement to critical and clear-minded thinking, and stimulation of intellectual curiosity, in forestry education.

[16]. 07.1 (73). GUISE, C. H. **Statistics from Schools of Forestry for 1946: degrees granted and enrollments.** *J. For.* 45 (3), 1947 (174–80).

At the beginning of the academic year 1946–47, the number of undergraduates enrolled in American forestry schools was 7,070, an increase of 5,537 on the previous year and the highest number that the schools have ever had, the previous record being 6,067 in 1937–38. Considerable concern is felt about their possibilities of employment.

[17]. 07.2 (48). ORDING, A. Emner fra skogforskningen. 1. Skogbotanikken. **[Recent advances in forest research. 1. Forest Botany.]** Grøndahl & Søns Boktrykkeri, Oslo. 1944. pp. 244. [Nor.] Price Kr. 2.

This book consists of a series of reviews, each with a bibliography (mainly of Scandinavian references) on the following subjects:—(i) The history of the forest vegetation of Norway. (ii) The distribution of conifers in Norway and conditions for natural regeneration at their limits of distribution. (iii) Limits of forest and tree growth. (iv) Annual-ring analyses with special reference to principles and methods of measurement. (v) Periodical or quasi-periodical climatic variations. (vi) Dendrochronology. (vii) The influence of temperature on the diameter growth of Norway Spruce and Scots Pine. (viii) The influence of temperature on the height growth of trees. (ix) The germination of seed at different temperatures and moistures. (x) Forest litter and its significance. (xi) Vegetation types and their use in forestry. (xii) Questions of provenance and seed supply. (xiii) Forest tree breeding. (xiv) Oak woods in Sørland: a comparison of Sessile and Pendunculate Oaks. (xv) Hardwood and coniferous foliage and bark as fodders.

[18]. 07.2 (494). SWITZERLAND. Règlement betreffend den Fonds für die Förderung der Wald- und Holzforschung. **[Regulation on the Fund for the Promotion of Forestry and Wood Research.]** *Suppl.* to *Schweiz. Z. Forstw.* 98 (1–3), 1947. pp. 5–7. [G.F.]

[19]. 07.2 (494) : 11.14.46 : 38.8 : 05.3. BUCHER, E. Bericht über die Tätigkeit des eidg.Instituts für Schnee- und Lawinenforschung im Jahre 1945/46. **[Report on the work of the Swiss Federal Institute for Snow and Avalanche Research, 1945-46.]** *Schweiz. Z. Forstw.* 98 (2), 1947 (75–81). [G.]

[20]. 07.2 (54 : 59.1) : 05.3. INDIA AND BURMA. **Forest Research in India and Burma, 1944-45. Part I. The Forest Research Institute.** The Forest Research Institute, Dehra Dun. [1946?] pp. 150.

[21]. 07.2 (71) : 05.3. CANADA. **Quarterly report of the forest products laboratories for the period ending October-December, 1946.** Dominion Forest Service, Forest Products Laboratories, Ottawa. 1947. pp. 21. P.R.

[22]. 07.2 (73). TERVER, P. Étude de l'organisation des recherches forestières aux Etats-Unis. **[Study of the organization of forest research in the United States.]** *Rev. int. Bois* 14 (116), 1947 (27–33). [F.]

[23]. 07.2 (931). RIGG, SIR T. **The contribution of the Cawthron Institute to science and New Zealand agriculture. With bibliography of scientific papers and reports.** Cawthron Institute, Nelson, New Zealand. [1945?]. pp. 58 + plates. (Silver Jubilee Commemoration Lecture, Oct. 29th, 1945).

[24]. 07.2 (94) : 05.3. AUSTRALIA. **Council for Scientific and Industrial Research: Division of Forest Products: programme of work for the year 1946-47.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1947. pp. 73.

09.1. *Forest History*

[25]. 09.1 (43.7) : 81 : 06.1 : 07.1 : 92. MACKO, L. Lesníctvo na Slovensku počas neslobody. [**Forestry in Slovakia during the period of subjugation.**] *Lesnická Práce* 26 (1), 1947 (22–34). [Slovak. e.]

A historical survey of the period 1938–45, with details of the organization of forestry, schools and training, legislation, societies, and literature published.

09.2. *Pre-history. Pollen Analyses, etc.*

See also *For. Abstr.* 9 (Nos. 140, 147, 155–6).

[26]. 09.2 (77.2). FRIESNER, R. C., and POTZGER, J. E. **The Cabin Creek raised bog, Randolph County, Indiana.** *Repr.* from *Butler Univ. Bot. Stud.* 8, 1946 (24–43).

Vegetational change was from *Picea glauca* to *P. mariana* to *Pinus/Quercus* to *Quercus* and other broadleaved species.

09.4. *Forest Statistics*

[27]. 09.4 (56.9) : 98.3 : 35. PALESTINE. **Empire forests during the war 1939-45 : Palestine.** Department of Forests, Jerusalem. 1947. pp. 28. [Fifth Empire Forestry Conference, 1947.]

[28]. 09.4 (66.4) : 06.2 (410). SIERRA LEONE. **Empire Forestry Conference, 1947: Empire forests and the war.** Govt. Printer, Freetown. 1947. pp. 30.

[29]. 09.4 (67.2) : 06.2 (410). BRASNETT, N. V., and EGGELING, W. J. (Compilers). **Uganda forests and the 1939–45 war. Statement prepared by the Forest Authority at the request of the Standing Committee on Empire Forestry, for the Fifth British Empire Forestry Conference, London, 1947.** Govt. Printer, Entebbe, Uganda. 1947. pp. 32.

[30]. 09.4 (91.1) : 06.2 (410). SPURWAY, J. C. **Forestry in the colony of Sarawak (1935-1940). A statement prepared for the Fifth Empire Forestry Conference 1947.** Govt. Printer, Kuching. 1947. pp. 4.

[31]. 09.4 (729.7) : 35 : 98. **Trinidad and Tobago: Empire forests and the war.** Govt. Printer, Trinidad. 1947. pp. 16 + tbls. [Fifth Empire Forestry Conference, 1947.]

The statistics given in these reports include average annual output of home-grown wood, annual imports and exports, gross annual imports of wood and wood products from different sources, gross annual exports of wood and wood products and their destinations, sterling value of annual output, imports, exports and domestic consumption, annual employment of labour in forest industries, all for the years 1939–45. Similar statistics are given for the years 1936–38 for purposes of comparison.

[32]. 09.4 (74.1) : 09.7. STEVENS, D. H. **Forest problems in Maine.** *Paper Tr. J.* 124 (5), 1947 (41–3). P.R.

According to the best records available, there are 16,200,000 acres of forested land in the state. The total estimates for the larger classifications of wood are as follows: 26,175,000 cords of Spruce, 11,687,000 cords of Fir, 27,200,000 cords of hardwood pulpwood, 71,620,000 cords of hardwood fuel wood, 5,000,000 cords of Hemlock and, in terms of cords, twice as much White Pine as Hemlock. The annual drain is given at 311,439,000 cu. ft., while the annual growth is only 275,800,000 cu. ft. according to the U.S. Forest Service. In the Spruce and Fir species the annual cut is about 220,000 cords less than the increment.

09.7. *Monographs of Individual Forest Regions*

See also *For. Abstr.* 9 (Nos. 5, 141, 149).

[33]. 09.7 (43.1–5) : 90. KIRCHER, J. C. **The forests of the U.S. zone of Germany.** *J. For.* 45 (4), 1947 (249–52).

The forests of the U.S. zone of Germany, which represent 36 per cent. of the forest area of present Germany, cover 8,850,000 acres or about one-third of the total area of the zone. These forests, which are 30 per cent. hardwoods and 70 per cent. conifers, have mostly

been planted, though natural regeneration is also used. Much Spruce and Pine was planted in pure stands 50–100 years ago, but younger stands generally have a mixture of hardwoods to keep up the quality of the soil. Even-aged and two-aged stands are the rule. Markets are so well developed that practically the whole tree can be utilized. Thinnings starting at 1 in. d.b.h. can be made to pay for themselves. Stands are usually worked over at 3- to 5-year intervals, starting at about 30 years, and rotations are relatively long (80–200 years). Growth figures compiled just before the war showed that state forests were growing at the rate of 455 bd. ft. per acre, large private holdings at 333 bd. ft., medium-sized ones at 242 bd. ft., and small ones not much over 100 bd. ft. The Germans state that the most economical unit of management is between 5,000 and 10,000 acres, and the figures support this view. Such an area allows the employment of a high-grade technical forester to manage the forest.

The U.S. Military Government is at present making a complete inventory of the timber resources of the zone, which will give volumes by age-classes and size, growth, and other information. At the same time, management plans are being brought up to date and those destroyed during the war are being replaced. Similar surveys are being made in the other 3 zones and when all are complete a forest cutting budget will be established to take effect from October 1947. The Allied policy will probably provide for shortening timber rotations and for the systematic removal of all timber above the new rotation age.

[34]. 09.7 (44). LACHAUSSÉE, E. La forêt de la Joux. [**The forest of La Joux.**] *Rev. Bois Appl.* 1 (4), 1946 (5–9). [F.] P.R.

[35]. 09.7 (44). VINEY, R. La forêt domaniale de Bercé. [**The state forest of Bercé.**] *Rev. Bois Appl.* 1 (9–10), 1946 (19–23). [F.] P.R.

[36]. 09.7 (489). JANSEN, J. J. M. and BLOKHUIS, J. L. W. De Deensche boschbouw. [**Danish forestry.**] *Ned. Boschb.-Tijdschr.* 19 (3), 1947 (65–80). [Du.]

Notes on a tour of study.

[37]. 09.7 (492) : 2 : 81 : 90 : 07. **Forestry in the Netherlands and the State Forest Service.** [Netherlands State Forest Service.] [? 1945.] pp. 20. [E.]

Contains chapters on the forest area, timber position, climate and soil, forest history, principal methods of afforestation of waste land, education and research, forest legislation. [Cf. *For. Abstr.* 8 (No. 873).]

[38]. 09.7 (492) : 81 : 94.1. BURGER, D. Het Staatsboschbeheer en de boschbouw in Nederland. [**The State Forest Service and forestry in Holland.**] *Tectona* 36 (7/8), 1946 (349–62). [Du.]

[39]. 09.7 (59.3) : 12.19.2 : 98 : 34 : 12.26–8: 32 : 56 : 66. FLUYT, P. C. M. Enkele boschbouwkundige aantekeningen over Siam. [**Notes on forestry in Siam.**] *Tectona* 36 (4), 1946 (215–30). [Du.e.]

Brief general notes on geography, climate and people, followed by an account of the forests of the northern part of the country: (i) mixed forests on lateritic soils, with no Teak; (ii) evergreen forests on deep rich soils with a moist climate, characterized by Dipterocarps, especially *Dipterocarpus* and *Shorea* spp., with locally a little Teak; (iii) mixed deciduous forests containing Teak in groups and pockets, never as large pure stands. Teak is claimed to be in its optimum environment and to attain its greatest dimensions in N. Siam; the largest tree encountered was 151 ft. high with a clear bole of 77 ft. and a g.b.h. of 29 ft. 5 in. Data on height, clear bole and girth at various ages are tabulated. The Teak forests are State-owned. Before the war 85 per cent. of the exploitation was by European firms, 14 by native concerns and only 1 per cent. by the Government itself. Increasingly strict regulation has had to be imposed to safeguard the yield. The Brandis Selection System is used, as in Burma. Brief notes are included on girdling, felling, transport, grading and conversion. Other commercial timbers of these forests are *Lagerstroemia balansae*, *L. calyculata*, *Pterocarpus indicus*, *P. macrocarpus* and *Xylia dolabriformis*. *Shorea obtusa* and *Pentacme siamensis* are the chief timbers used by the railways for sleepers, poles and bridge timbers; the railways also use a good many local woods as fuel. Important minor forest products are Bamboo, stick lac and yang oil from *Dipterocarpus alatus*. Data are given on exports of Teak in 1929–30; later data are

inaccessible owing to political troubles. Before the war, exports of timber to China and Japan appear to have been increasing.

[40]. 09.7 (69) : 81. SABOUREAU, P. Le service des eaux et forêts à Madagascar. [**The forest service in Madagascar.**] *Rev. int. Bot. appl. Agric. trop.* 26 (286), 1946 (475–90). [F.] P.R.

The Forest Service of Madagascar dates from 1900. The present organization is based on a decree issued in 1937 and was revised in 1943. There are 5 territorial charges under a Conservator. The central offices deal with administration, accounts, legal matters, management, sales, afforestation, research and education.

The forest area is between 7 and 10 million ha. On the east slope is evergreen rain forest which, where destroyed, is replaced by light-demanding types, the *savoka*. The centre and west were originally covered with dry deciduous forest which has been succeeded by savanna with scattered Palms. The south carries dry thornbush. Characteristic species of each of the six main formations are enumerated; the island still contains at least 2,000 species of trees although nine-tenths of the flora has been destroyed. The remnants of primitive forests are preserved in 'natural reserves' and 'protected sites'. 'Regeneration reserves' are intended to protect understocked and eroded areas; when regeneration has been established and the forests have been improved they are transferred to 'forest reserves' and 'protection forests'.

About 350,000 ha. are now classed as forest reserves and regeneration reserves and about 400,000 ha. as natural reserves. Approximately 45,000 cu.m. of wood are felled annually by lessees and permit holders. Transport is primitive and exploitation difficult and undeveloped. Raffia from a Palm, *Raphia ruffia*, is widely used for domestic purposes. The forests are menaced by shifting cultivation (tavy) and by grass fires and also by exploitation on permit. The Forest Service has undertaken reforestation in various regions, however, which amounts to about 750 hectares annually.

[41]. 09.7 (86) : 12.19.1. ACOSTA SOLÍS, M. **Commercial possibilities of the forests of Ecuador—mainly Esmeraldas Province.** *Trop. Woods* No. 89, 1947 (1–47).

The total area of well forested land is about 32,000 sq. km. and of second-growth or heavily culled forest 6,000 sq. km., or about 12·5 per cent. of the total land area. The composition of the forest is affected to a considerable extent by the altitudinal temperature gradient, which changes at the rate of one degree centigrade for each 200 m. change in altitude. Forest types include Mangrove forest on the coast, high tropical montane forest, chapparal, rain forest. Of recent years there has been much planting of *Eucalyptus globulus*, which does well at elevations of 1,800–3,000 m. in the inter-Andean region [cf. *For. Abstr.* 8 (No. 180)]. Exploitation of forest resources has hitherto been very primitive and, except for Balsa, little timber has been exported. Reasons are given for locating a forest industry in Ecuador and it is concluded that the forests of Esmeraldas Province (about 5,000 sq. km.) which are near the Panama Canal are the most promising for this purpose. Some account is given of the forest types and topography of the province. The article concludes with an alphabetical check list of the principal forest species of Ecuador.

[42]. 09.7 (86) : 33.1 : 35. SHINOL, J. W. **Forest resources, lumber industries, and trade in Ecuador.** *Industr. Ref. Serv. U.S. Dep. Comm.* 4 (Part 6, No. 51), 1946. pp. 14.

Of Ecuador's three geographical regions, the Sierra, the Litoral and the Oriente, the Litoral offers the best possibilities for the export of timber. Very little legislation has been introduced in Ecuador concerning forest protection, exploitation and reforestation, and no adequate appraisal has been made of the country's timber resources. There is a generally heterogeneous rather than a pure-stand distribution of commercially desirable species. During the war there was considerable concentration on the Balsa industry but the demand for it is now declining. Eucalyptus is cultivated for local needs. Well-known tropical hardwoods are used for cabinet-making but the industry is unorganized. The report gives a description of the main Ecuadoran commercial species with their properties and uses. In 1943 there were approximately 75 sawmills in Ecuador with 33 of them in Balsa production. Annual output, based on the figures for September, 1944, was estimated at between 38,268,000 and 39,108,000 b.f. The estimated production of 19 of the 22 sawmills in the Guayaquil area

was between 2,295,000 and 2,365,000 b.f. per month. The lumber industry is unorganized and costly owing to primitive logging methods, climatic and topographical drawbacks, inadequate transport, and labour problems. The sawmills contain some archaic equipment and methods, but during the war some modern equipment was imported from America for the Balsa industry, and standard air-seasoning methods and dry kilns were introduced. Recommendations are made concerning the development of the forest resources and the establishment of a permanent industry in Ecuador.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1 *Atmosphere*

11.15. Light

[43]. 11.15 : 12.11.16 : 12.11.23. SEMMENS, E. S. **Chemical effects of moonlight.** *Nature, Lond.* 159 (4044), 1947 (613).

Experiments carried out in South Africa, exposing starch grains, boiled starch, and living leaves to bright moonlight, showed that moonlight, being polarized, has a hydrolysing effect on reserve food in plants and acts as a digestive tonic. The same effect is produced by artificially polarized light. The author suggests that this digestive tonic action of moonlight, when acting without a compensating supply of extra food, may explain some of the conflicting results claimed for the influence of phases of the moon on plant growth.

[44]. 11.15 : 22.14.2 : 12.25. WELLNER, C. A. **Estimating light intensity in residual stands in advance of cutting.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 47, 1946. pp. 4.

A table is provided showing stand density equivalents for given light intensities beneath the canopy in mature stands of the Western White Pine type. The use of the table to determine the rate of cutting in any given stand in order to obtain a desired light intensity is illustrated by an example.

11.2. *Climate and Microclimate*

See also *For. Abstr.* 9 (Nos. 17; 144, 633).

[45]. 11.2 : 11.14. MICHELMORE, A. P. G. **A popular misconception regarding humidity, and the need for closer liaison between meteorologists and ecologists.** *J. Ecol.* 34 (1), 1947 (107–10).

Observations in Africa show that the effect of evaporating bodies of water and swampy vegetation on the humidity and the general climate of the surrounding country is much smaller and more localized than is commonly believed, at least by those who are not trained meteorologists. The author advises that in making humidity determinations for ecological purposes, the absolute humidity, relative humidity and saturation deficiency should all be computed.

[46]. 11.2 (66.68) : 11.14.2 : 12.19.2 : 91.3 : 96. AUBRÉVILLE, A. Les saisons sèches dans les régions forestières de l'A.O.F. Conséquences pour les programmes de protection des forêts et les plantations agricoles industrielles. [**The dry seasons in the forest regions of French West Africa. Their consequences to forest protection and commercial agricultural plantations.**] *Rev. int. Bot. appl. Agric. trop.* 25 (275/6), 1945 (95–101). [F.] K.

The writer shows that the area of deciduous forest in the Ivory Coast and French Guinea corresponds with the area in which there is a dry season of two months with less than 30 mm. of rain. In general there is a remarkable correlation between rainfall and forest type on the one hand, and the orientation of the coast in relation to the direction of the monsoon on the other hand, over the whole coast of the Gulf of Guinea, from French Guinea to the Cameroons. Where the coast faces the monsoon, there are abundant rains and typical rain forest, but where the direction of the coast-line is parallel to that of the monsoon, the coast is relatively dry and there are more xerophilous forest formations, deciduous forest, and even bush formations on the coasts of the Gold Coast and Togoland. In the lower Ivory Coast, the effect of the low rainfall in the dry

season is reinforced by the action of the harmattan, a dry East wind. The forest plays an important part in lessening the effect of this wind on the coastal plantations and it is recommended that the following measures should be taken to stop the regression of the forest and increase of savanna in these areas:—(1) Stabilization of the existing boundaries of the forest by forbidding fresh clearings and reserving all forests not absolutely necessary to the life of the native population. (2) Reservation and protection of all vestiges of forest which survive north of this line of defence in regions which have been invaded by savanna. (3) The creation, south of the forest boundaries, of large new commercial plantations, especially those consisting of large areas of a single species.

[47]. 11.21 (47 : 57) : 56 : 12.19.4. TIKHOMIROV, B. A. K voprosu o dinamike polyarnogo i vertikal'nogo predelov lesov v Evrazii. [**The problem of the 'dynamics' of the polar and altitudinal limits of forest in Eurasia.**] *Sovetsk. Bot.* No. 5/6, 1941 (23–38). [Russ.] [V. L. Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R.] O.B.D.

Data of 1940 for 60 sample trees, 19–52 years old from the altitudinal limit of tree growth in the central and southern Ural Mts., showed a uniform increase of current height and diameter increment for the last 5 years, and a marked tendency for increment to increase over the last 10 years preceding the observations. Many data from other sources bear witness to increasing warmth in the last two decades, hence there has been a lag in the expression of the improvement as tree increment. It is difficult to say whether this change has yet had any effect such as an advance of the tree line upwards and northwards, but the widespread idea of a continuance of the cooling of the climate after the warm post-glacial period appears to require revision. Unless there is a relapse, shifts may be expected in both altitudinal and latitudinal limits of tree and other vegetation, and it is of great importance that investigations of increment and ecological studies in such zones should be continued.

[48]. 11.22 (69) : 12.19.2 : 12.14.5. VAUGHAN, R. E., and WIEHE, P. O. **Studies on the vegetation of Mauritius. IV. Some notes on the internal climate of the upland climax forest.** *J. Ecol.* 34 (1), 1947 (126–36).

The internal climatic conditions of the upland climax forest have been studied, and data for temperature, rainfall and humidity obtained for sites inside the forest and at an exposed site near by. The mean monthly range of temperature in the forest was only 7·4° F. during the year, little more than half the value observed for the normal climate. Screen mean minima for the month were about the same for both stations, but the maxima in the forest were always about 6·0° F. below the exposed station. Two-thirds of the total rain falling on the canopy directly reached the forest floor. The most striking feature of the internal climate is the high and remarkably constant relative humidity, the daily range of which did not exceed 5 per cent. of saturation for the greater part of the year. These climatic conditions are probably confined to a zone extending from the forest floor to a height of about 3–4 m., above which a rapid grading-off to the temperature and humidity of the outside air takes place. The plant life living in this zone includes the sparse ground flora and shade-loving epiphytes as well as seedlings of plants belonging to higher strata, which pass a considerable period of their young life in an atmosphere very different from that which they will experience when mature. Little is known yet about the leaf anatomy of these plants, but an examination of the external leaf morphology gives the impression of very great diversity of form, texture and coloration, even within the same species. [Cf. *For. Abstr.* 1 (244); 3 (33).] *From authors' summary.*

11.4. *Soil*

See also *For. Abstr.* 9 (Nos. 645, 690).

11.43. Biology of Soil, including Mycorrhiza

[49]. 11.41.3 : 07.7. BOUYOUCOS, G. J., and MICK, A. H. **An electrical resistance method for the continuous measurement of soil moisture under field conditions.** *Tech. Bull. Mich. agric. Exp. Sta.* No. 172, 1940. pp. 38.

[50]. 11.43 : 11.44 : 11.42.31. BOSWELL, J. G., and GOVER, D. J. **The microbiology of acid soils. I. 'Mor' bearing *Pinus sylvestris* and *Betula pubescens*.** *New Phytol.* 45 (2), 1946 (218–24). [Sheffield Univ.] O.B.D.

A mor bearing *Pinus sylvestris*, *Betula pubescens* and *Deschampsia flexuosa* was examined from the chemical and biological aspects. All the major groups of soil micro-organisms were well represented except the nitrifiers, which were present only in very small numbers. In spite of the low pH, a cellulose-decomposing bacterium and nitrogen-fixing bacteria were isolated.

[51]. 11.43 : 45.3 : 44.1. UNITED STATES. **[Effect of herbicides and insecticides on soil micro-organisms.]** *Rep. U.S. Bur. Pl. Ind.* 1946 (10–11).

Observations were made on the effect of 2,4-D on the total number of viable micro-organisms and of fungi, actinomycetes, protozoans and nitrite- and nitrate-forming bacteria. Two soils (a silt loam and a sandy loam) were treated at rates of 1, 2, 10, 50 and 200 lb. per acre, with an additional application of a 1,000-lb. rate to part of the sandy soil. The only groups affected were the nitrite- and nitrate-forming bacteria, which were greatly reduced in both soils by the 200-lb. application. DDT at rates of 25, 50, 100, 200 and 400 lb. per acre in the same two soils had no effect on any of the soil micro-organisms over a period of 7 months.

[52]. 11.43.1 : 01.6. KELLEY, A. P. **Additions to the literature of mycorrhizae.** Landenberg, Pa. 1947. pp. 15. [*Suppl.* No. 9 to *The Literature of Mycorrhizae.*]

[53]. 11.43.1 : 11.44 : 12.11.15. MELIN, E. Der Einfluss von Waldstreuextrakten auf das Wachstum von Bodenpilzen, mit besonderer Berücksichtigung der Wurzelpilze von Bäumen. **[The effect of forest-litter extracts on the growth of soil fungi, with particular reference to the mycorrhizal fungi of trees.]** *Symb. Bot. Upsalienses* 8 (3), 1946. pp. 116. [G.e.] L.S.

Extracts prepared from recently fallen litter of 7 different tree species and one grass were tested for their effects on the growth of 9 mycorrhizal fungi of conifers, *Mycelium radicis atrovirens* (frequently parasitic on tree roots), 11 saprophytic soil fungi, and, for comparison, *Phycomyces blakesleeanus*.

All types of litter contained water-soluble substances that promoted growth of both thiamin-heterotrophic (mycorrhizal hymenomycetes and gasteromycetes, as well as litter-decomposing hymenomycetes) and thiamin-autotrophic soil fungi, the effect varying with the species of fungus concerned. For mycorrhizal fungi the relative increase of growth was mostly 150–300 per cent. (the maximum increase—up to 60 times that in the absence of extract—being given by *Lactarius deliciosus*), and growth of litter-decomposing hymenomycetes was also greatly stimulated. In most cases the growth response was not proportional to the amounts of extract added. By giving extracts in sub-optimal amounts it was possible to eliminate effects of organic constituents that could be used by the fungi as structural material, and to study the effects of ash constituents and growth substances. For reasons which are still obscure, growth responses of various fungi to the HCl-soluble ash constituents were anomalous. The thiamin-heterotrophic fungi failed to achieve their maximum growth rate in a nutrient solution containing thiamin in excess, sugar, and salts including the HCl-soluble litter-extract ash constituents. Results indicated the probable occurrence in the extracts of one or more unknown growth substances having a generalized rather than specific growth-promoting effect.

Further experiments were made to compare the activity of *Phycomyces* extract with that of litter extracts, and to investigate physico-chemical properties of the presumed growth substance in litter. The results are seen as strong circumstantial evidence that the litter extracts contain—besides known growth substances such as thiamin and biotin—substances identical with Robbins' 'factor Z'. If so, the influence of the last-named on different fungus species probably varies with their varying ability to synthesize one or both of its components. Growth experiments with several purines (hypoxanthine, adenine and guanine) make it improbable that any of these can be identical with the Z factors presumed to exist in the litter extracts.

Leaves of Maple, Birch, Beech, Oak, Aspen and Pine also contained water-soluble substances which inhibited the growth of many soil

hymenomycetes to varying degrees, mycorrhizal fungi being the most sensitive and litter-decomposing species insensitive in this respect. Passage through a Seitz filter had no noteworthy effect on the activity of these substances. In some cases the inhibitory action was intensified by autoclaving (120° C.) the cold-water extracts; this was especially so with Maple litter extract, which after autoclaving severely inhibited both mycorrhizal and litter-decomposing hymenomycetes. The water extract of the grass *Glyceria maxima* had no inhibitory effect on the fungi tested.

[54]. 11.43.1 : 11.44 : 12.21 : 31.42.1 LINDEBERG, G. **Thiamin and growth of litter-decomposing hymenomycetes.** *Bot. Notiser, Lund* No. 1, 1946 (89–93). [E.] [Univ. of Uppsala.] O.B.D.

Only two of the wood-destroying and soil-inhabiting fungi tested (viz. *Clitocybe geotropa* and *Hypholoma fasciculare*) showed any ability to form thiamin. It seems, therefore, that the hymenomycetes which decompose litter are to a very large extent thiamin-heterotrophic. On the other hand, auxo-autotrophy as well as complete inability to form growth substances other than thiamin seem to be relatively rare. The addition of 50γ thiamin per litre nutrient solution induced growth in all species.

[55]. 11.43.1 : 12.21 : 11.44. LINDEBERG, G. **On the decomposition of lignin and cellulose in litter caused by soil-inhabiting Hymenomycetes.** *Ark. Bot.* 33A (10), 1947 (1–16). O.B.D.

Investigations were made on the ability of certain soil-inhabiting hymenomycetes to decompose lignin and cellulose in sterilized litter (Beech leaves, straw and leaves of *Glyceria maxima*).

Most species attack lignin and cellulose to about an equal extent, but a few, including *Collybia butyracea, Clitocybe alexandri, Clavaria dendroidea* and *Clavaria ligula*, attack lignin especially strongly but cellulose only to a slight extent. *Clavaria gracilis* attacked the lignin of Beech leaves rather intensely, but did not decompose cellulose.

[56]. 11.43.1 : 11.42.2 : 12.26–8 : 12.11.1. KEILIN, D., and SMITH, J. D. **Haemoglobin and nitrogen fixation in the root nodules of leguminous plants.** *Nature* 159 (4047), 1947 (692–4).

A study was made of the state of haemoglobin within the nodules of plants kept under different conditions. The facts that haemoglobin is present in root nodules of every leguminous plant, that the pigment is formed only in nodules produced by an 'efficient' strain of *Rhizobium*, that the pigment is localized only within the large cells containing symbiotic organisms and that nitrogen fixation by nodules is strongly inhibited by small concentrations of carbon monoxide, leave very little doubt that the activity of haemoglobin is linked with the process of symbiotic nitrogen fixation. The presence of haemoglobin in root nodules, therefore, will have to be taken into consideration in all further studies of nitrogen fixation by leguminous plants.

[57]. 11.43.1 : 12.26–8 : 12.14.3. PLOTHO, VON. Untersuchungen über die Symbiose der Erlen. **[Investigations on symbiosis of Alder.]** *Forschungsdienst* 17 (12), 1944 (619–20). [G.] A.P.B.

An actinomycete isolated from root nodules of *Alnus incana* in 1938–9, when introduced into the N-free nutrient solution in which Alder seedlings were grown under sterile conditions, caused root nodules to develop by the summer of 1940 on about one-eighth of the plants in the series, whereas controls, whether supplied with N or not, remained without nodules. One of the inoculated plants developed a nodule on the main root which was 4·5 cm. in diameter after 3 years' growth: in autumn, 1942, this plant, grown the whole time in a medium free of N compounds, had a root 60 cm. long and a stem, with many lateral branches, 1·3 m. tall and 10·7 cm. in girth at the root collar. The nutrient solution in which the successfully inoculated plants were grown showed no significant gain of N as compared with controls.

[58]. 11.43.1 : 12.26–8 : 12.21 : 12.14.3. CASTELLANOS, A. Los tuberculos radiculares del aliso (*Alnus jorullensis* H.B.K. var. *spachii* Regel). **[The root tubercles of *Alnus jorullensis* var. *spachii*.]** *Lilloa* 10 (2), 1944 (413–6). [Span.e.] A.P.B.

Illustrated description of the root tubercles of *Alnus jorullensis* var. *spachii*, the ♂ and ♀ flowers of which are figured.

[59]. 11.43.1 : 12.26–8 : 12.21. BOSE, S. R. **Hereditary (seed-borne) symbiosis in**

***Casuarina equisetifolia* Forst.** *Nature, Lond.* 159 (4041), 1947 (512–4). [Carmichael Medical College, Calcutta.]

Examination of a number of *Casuarina equisetifolia* trees of all ages, from different parts of India and Australia, showed that in every case hyphae of *Phomopsis casuarinae* were present in every organ, beginning from the seed coat. Application of pure cultures of *P. casuarinae* to a number of pot-plants and seedlings in humus soil showed that abnormal pot-plants and very weak seedlings in a moribund condition were killed outright by the fungus, which became strongly virulent and parasitic, while slightly weak but normal seedlings were greatly invigorated by the inoculation.

Besides the fungus, *C. equisetifolia* bears coralloid roots or nodules due to infection with the bacterium *Rhizobium casuarinae*, and it seems clear that symbiosis of plant, fungus and bacterium is necessary for successful and healthy growth of the tree.

[60]. 11.43.1 : 12.21. GOLLERBAKH, M. M. Sovremennoe sostoyanie voprosa o roli vodorosley v pochve. **[The present state of knowledge of the rôle of algae in the soil.]** In *Sbornik Nauchnÿkh Rabot . . . (1941-1943).* Botanicheski Institut im. V. L. Komarova, Leningrad. 1946. pp. 399–412. [Russ.] 88 refs. [A review.]

[61]. 11.43.2 (43.7). MELICHAR, J. Několik slov o edafonu lesních půd. **[Notes on the fauna of forest soils.]** *Lesnická Práce* 26 (1), 1947 (15–22). [Cz.e.]

Melicher studied the soil fauna of Norway Spruce woods (with a slight admixture of Silver Fir and Beech) on dissected ground at 600–800 m. elevation, and of some felled areas. Samples were obtained by digging a hole at the edge of the quadrats deep enough to allow the insertion of a stiff plate with which sections of fairly uniform depth could be cut off and lifted. Isolations were performed with the aid of a home-made Berlese funnel. The catch, killed with boiling water, was estimated by placing transparent squared paper under the Petri dish and calculating on the basis of counts of a number of squares.

Results showed that the highest populations occurred under forest stands and the lowest on clearings. The older the stand the higher was the soil population. In contrast to results obtained by Soudek, Acarina were the most abundant in all the forest samples and Collembola took second place; other arthropods were far less numerous, and worms were sometimes absent, sometimes present in small numbers. Samples from clearings gave very variable results, and either Acarina or Collembola might dominate locally. The optimum habitat for the fauna appears to be the litter layer: in the upper humus layers there is a marked drop in populations, which continue to decrease with increasing depth. Results (only the major groups Acarina, Collembola, other arthropods, and Vermes are distinguished) are illustrated in tables and graphs.

A few isolations of bacteria suggest that their optimum habitat is deeper than that of the soil fauna.

[62]. 11.43.2 : 11.44 : 12.26–8. NOORDAM, D., JR., and VLIEGER, S. H. VAN DER VAART-DE. Een onderzoek naar samenstelling en beteekenis van de fauna van eikenstrooisel. **[An investigation on the composition and significance of the fauna of Oak litter.]** *Ned. Boschb.-Tijdschr.* 16 (12), 1943 (470–92). [Du.e.] [Biologisch Laboratorium "Hoenderloo," and Laboratorium voor Alg. Zoölogie der Rijksuniversiteit te Utrecht.]

The litter fauna of a Dutch Oak wood was studied over a complete year from autumn to autumn. Results for the uppermost litter layer showed low populations in newly fallen material, with an increase in spring, decreases during dry periods, and an increase to peak numbers in the moister weather of later summer and autumn, when populations were 2–5 times those in spring. The densest population was about 22,000 per sq. m. It was obvious that the lower (older) litter layers had a far richer fauna, but no counts were made in this instance. Differences are noted between the faunas of a north slope with, and a south slope without, underwood, and cases are distinguished which are likely to be due to pure chance, vegetation, insolation, and drought. Collembola were less resistant to drought than Acarina and showed their highest numbers in February-March and at the end of October, whereas peak populations of Acarina occurred in March-April and August-September.

Laboratory cultures were also made of Acarina and Collembola on Oak leaves and observations on the survival, feeding and

feeding pattern of the various species are recorded.

11.44. Litter. Surface Humus

See also *For. Abstr.* 9 (Nos. 17, 50, 53–5, 62).

[63]. 11.44 (77.1). GYSEL, L. W. **Types of forest humus layers in the gray-brown podzolic and associated soils in Ohio.** *Proc. Soil Sci. Soc. Amer. 1945*, 10, 1946 (414–5). [Central States For. Exp. Sta., Urbana, Ill.] L.S.

[64]. 11.44 : 11.42.3 : 12.11.11. MATTSON, S., and KOUTLER-ANDERSSON, E. **The acid-base condition in vegetation, litter and humus: VIII. Forms of acidity.** *LantbrHögsk. Ann., Uppsala* 12, 1944–45 (70–100). [E.] O.B.D.

A study of natural litter and humus, various forms of vegetation (mosses, lichen, algae, and green leaves of Birch, Beech, Oak, Alder, Ash, Elm and Pine), and artificial "sugar humus", fructose and tannic acid.

A distinction is drawn between active and potential acidity. Active acidity includes soluble acids (distillable acids and acids which, on boiling with 12-per-cent. HCl, split off CO_2), hydrolysable acidoids (consisting almost exclusively of relatively strong acid groups and including the polyuronides of the hemicellulose fraction—pectins, gums, mucilages) and non-hydrolysable acidoids (containing a preponderance of weak phenol hydroxyl groups and represented by the "lignin" acidoids). Different forms of vegetation and litter may differ greatly in the relative proportions of the two forms of acidoids. The specifically humic acidoids are of the non-hydrolysable type and their titration curves closely resemble those of autoxidized 'lignin'. Potential acidity is classified as hydrolytic, saponification and oxidation acidities, and a method of determination is described. Potential acidity is very high in Beech leaves as compared with those of Ash and the base content of the former is less than half that of the latter. Humus gives little or no hydrolytic acidity. Saponification and oxidation acidities were smaller in a neutral than in an acid humus.

[65]. 11.44 : 11.42 : 12.11.11. MATTSON, S., and KOUTLER-ANDERSSON, E. **The acid-base condition in vegetation, litter and humus: IX. Forms of bases.** *K. LantbrHögsk. Ann.* 13, 1946 (153–78). [E.e.] O.B.D.

The 'bases' (cations) present in plant materials occur in different forms of combinations which may be separated into the following groups: (1) cations of soluble, organic and inorganic salts; (2) cations in combination with acidoids; (3) cations of insoluble precipitates such as calcium oxalate; and (4) cations of metal-organic compounds which do not dialyse.

The present paper is a report on a study of the distribution of the common cations (K, Mg, Ca, Mn) between these four forms of combinations in different plant materials. The investigation embraces also the distribution of phosphoric acid and silica. The results show that a large proportion of the divalent cations, mostly Ca, exist in combination with plant acidoids and are removable only by exchange. Beech leaves and Ash leaves contained large to moderate amounts of oxalate-precipitated (acid-soluble) Ca. The oxalate increases with the maturity of the material, as shown by 5 seasons' growth of Spruce needles. *From authors' introduction and summary.*

[66]. 11.44 : 11.49.3. PLICE, M. J. **What is mull soil?** *Proc. Soil Sci. Soc. Amer. 1945* 10, 1946 (410–3). [Oklahoma Agric. Exp. Sta., Stillwater.] L.S.

Mull is formed where reduction processes dominate and mor where acidation is dominant. Moisture and dissolved oxygen govern these processes. The present study may indicate that prairie soils belong to the mull humus type and that all humus types belong either to mor or mull or to their variants. *From author's summary.*

[67]. 11.44 : 12.19.23 : 12.26–8 : 12.23. ANDRÉ, P. Bärrisens och mossornas förnaproduktion i ett mellansvenskt barrskogsbestånd. [**Production of litter by *Vaccinia* and mosses in a central-Swedish mixed coniferous forest.**] *Svenska SkogsvFören. Tidskr.* 45 (2), 1947 (122–31). [Sw.]

The sample plot investigated was under about 100-year-old mixed forest of Norway Spruce (about 70 per cent.) and Scots Pine (about 30 per cent.) of volume density 0·6 and apparently unthinned for the past 20-30 years, in Stockholm County, on an iron-podzol moraine soil with a very acid mor layer about

6 cm. deep. The field layer was composed almost exclusively of *Vaccinium myrtillus* and *V. vitis-idaea* with a moss carpet in which *Hylocomium parietinum* and *H. proliferum* were dominant, *Ptilium crista-castrensis* common, and *Dicranum scoparium* and *Polytrichum commune* rare.

Litter of the *Vaccinia* was collected at intervals over the period 8 Apr. 1945 to 30 Jan. 1946, in galvanized trays (1 × 1 dm. square and about 3 cm. deep) with perforated bottoms, let in to the ground flush with the surface of the moss carpet. For the period mentioned, the total dry weight of *Vaccinium* litter per tray averaged 712 ± 155 mg., made up of 361 mg. leaves of *V. myrtillus*, 209 mg. leaves of *V. vitis-idaea* and 142 mg. 'other' litter (berries, branchlets, perianths, etc.). Of these quantities, ash and N made up respectively 27 and 9·6 mg. for the whole sample per tray, 17 and 6 mg. for leaf litter of *V. myrtillus*, 6 and 2·2 mg. for that of *V. vitis-idaea*, and 4 and 1·4 mg. for "other" litter. It is estimated that the figures for a complete year would have been equivalent to 742 ± 155 kg./ha. of dry litter substance, containing 28 kg. ash and 10 kg. N.

Moss litter was measured indirectly, being taken as equal to the last year's growth. Patches of moss were removed on 17 Nov. 1945 and, after measurement of their area, were separated into individual stems from which the latest year's growth was cut off for weighing and ash and N determinations. On this basis the annual production per ha. is calculated as 713 ± 59 kg. dry substance, containing 26 kg. ash and 7·3 kg. N.

The total annual litter production per ha. of the moss and *Vaccinia* together thus comes to 1,455 ± 166 kg. dry weight, of which 54 kg. are ash and 17·3 kg. N. The annual wood increment of the tree layer equals about 950 kg. dry weight, or about 50 per cent. less than the litter production of the field layer. It should be noted, however, that the sample plot had an unusually complete cover of *Vaccinia* and mosses.

11.45. Geological Conditions. Soil Surveys

[68]. 11.45.2 : 12.19.2 : 12.19.3. ALINARI, E. L'influenza della vegetazione sul processo evolutivo di formazione del terreno. **[The influence of vegetation on the process of soil formation.]** *Ital. for. mont.* 1 (5), 1946 (171–9). [It.]

After outlining the influence of the environment on soil formation, the particular influence of certain forest species, e.g. Spruce and Beech, and other forms of vegetation, e.g. *Erica*, *Calluna vulgaris*, etc., is examined in more detail.

[69]. 11.45.9. GUPTA, R. S. **Scientific methods of recording soil and site characteristics in the field and collecting soil samples for laboratory examination.** *Indian For.* 73 (2), 1947 (51–61). [Forest Research Institute, Dehra Dun.] (7th Silvicultural Conference (1946), Dehra Dun.)

11.47. Maintenance of Favourable Soil Conditions

See also *For. Abstr.* 9 (Nos. 98, 516, 644).

[70]. 11.47 (66 : 67). GAUTIER, J. L'amélioration des sols d'Afrique tropicale. **[Improvement of the soils of tropical Africa.]** *Rev. int. Bot. appl. Agric. trop.* 26 (289–90), 1946 (622–31). [F.] P.R.

A short outline of the methods for (1) preventing further degradation, (2) restoring fertility to soil whose degradation is not irremediable. The first can be done by the use of judicious rotations and forest fallows, the second often calls for the eradication of *Imperata* in the first place, and then reforestation—a long and costly process. When reforesting savanna not infested with *Imperata*, the principal necessity is protection against fire. It is recommended that the area to be regenerated should be surrounded by trees of rapid growth and drought-resistant foliage, to form a fire-break. *Cassia siamea* is recommended for these fire belts, which should be at least 100 m. wide.

[71]. 11.47 : 11.49.5 : (49.4) : 23.52. BURGER, H. Bodenverbesserungsversuche. III. Mitteilung. Versuche im Gemeindewald von Langenthal und im bernischen Staatswald Biglenwald. **[Experiments on soil improvement. III. Experiments in the communal forest of Langenthal and the State forest of Biglenwald, Berne.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (2), 1946 (517—79). [G.g.f.]

An account of experiments in remedial treatments against incipient Sphagnum bog formation in the forest, a phenomenon attributed to the effects of clear fellings with intermediate agricultural use of the soil, and to the cultivation of non-local tree species in pure stands.

(i) *Burning experiments*: Drainage alone is not sufficient to bring about demonstrable soil improvement in a reasonable time: moss and mor must therefore be burnt *in situ* (rarely possible in Switzerland) or removed and burnt when dry with slash. At Langenthal, bog formation was not far advanced: here drainage, removal of moss and mor, and the scattering of their ashes with 50–100 kg. of ground limestone per acre, followed by the cultivation of hardwoods adapted to the site, has in 18 years considerably improved the physical condition and reaction of the soil. Pedunculate Oak, Ash, Maples, Beech, Elms and Alders must form the main crop in future. In the Biglenwald, where bog formation was further advanced, an application of 100 kg. of ground limestone per acre, after removal of the moss and mor, has markedly reduced acidity in the upper soil horizons. After 5 years, a rise in pH was evident to a depth of 10–15 cm., and after 16 years, to 20–30 cm., though at the latter time the pH was again decreasing at the surface. Plots cleared of moss and mor, and treated only with their ashes, again developed closed cover of *Polytrichum* and *Calluna* in 5 years, with abundant Spruce and Pine seedlings but few of the plants normally appearing in clearings on better sites. Limed plots showed a rich ground flora of the latter plants in the first 1–2 years, but fewer conifer seedlings. Inoculation with a good active mull can temporarily enrich the ground flora. Adequate liming, without soil inoculation, will produce a desirable, humus-decomposing ground flora which cannot be obtained by inoculation alone. On limed plots, natural regeneration of Sallow and the planted Common Alder made better height growth than Spruce, but on unlimed plots the latter took the lead. Even on limed plots, however, so much Spruce regeneration appeared that the areas would revert to pure Spruce if left to nature.

(ii) *Sowings of soil improvers* (*Biglenwald*): Sainfoin and chicory were failures on both limed and unlimed plots; "tall yellow gentian" was fair on the limed plots, but even there could exert no measurable influence on the soil. Perennial lupin was poor and died out on unlimed plots, but throve on limed plots and persisted for 18 years without further aid. Broom soon died on limed plots but maintained itself on unlimed ones until almost completely killed by the severe winter of 1939–40. On unlimed plots, *Polytrichum* and locally *Calluna* and *Sphagnum*, came back, and there was dense natural regeneration of conifers. Limed plots, even in the absence of inoculation with mull soil, developed a rich ground flora in which fewer Spruce seedlings were able to gain a hold, although Spruce would dominate in the long run if the areas were left undisturbed.

(iii) *Intercultivation of auxiliary species* (*Biglenwald*): Small-leaved Lime, White Poplar, Norway and Sycamore Maples, Sallow and *Sambucus racemosa*, failed or grew very poorly in the absence of liming. Sycamore Maple was particularly responsive to liming; Hazel, Aspen, Rowan, Pedunculate Oak, and Grey and Common Alders responded to liming, though they were not so dependent upon this treatment. For the stifling of oxyphilous ground vegetation and the stimulation of humus decomposition, the auxiliary species must rapidly give good shade and abundant leaf litter which is readily decomposed and is acceptable to the soil fauna. Hazel and the two Alder species meet all these requirements fairly well. Birch, Ash, Rowan and Alder Buckthorn have readily decomposed litter but yield too little of it and too little shade. Small-leaved Lime and Sycamore Maple have less readily decomposed litter, but the Lime gives good cover, and both species yield abundant litter. Beech, Sycamore, Maple, and to some extent Pedunculate Oak, need liming but can form part of the main crop. Aspen produces little shade, little litter and that not readily decomposed. As in other experiments, abundant Spruce regeneration appeared in all plantings and throve on both limed and unlimed plots, and clearly only intervention by man can prevent regression to pure Spruce. Some observations are included on the times of flushing and leaf-fall of the various species, and some degree of correlation is noted between type of autumn coloration and the nitrogen content and ease of decomposition of the leaves.

[72]. 11.47.13 : 12.25. LUNT, H. A. **Effect of fertilizer treatment on field-planted**

Spruce. *Proc. Soil Sci. Soc. Amer. 1945* 10, 1946 (406–9). [Connecticut Agric. Exp. Sta., New Haven.] L.S.

A study of the effect of (*a*) previous fertilizer treatment in the nursery, and (*b*) fertilization at the time of field planting on White Spruce and Norway Spruce, 2–1 nursery stock.

In (*a*), nursery treatments included 12–4–4, 4–12–4, 4–4–12, and 8–8–8 mixtures applied at the rates of 400, 1,200 and 2,000 pounds per acre, and various combinations of N, P, and K applied in solution. In an unreplicated set, the wide variation in survival and growth of the checks indicated soil and other growth-factor differences as large as those resulting from previous nursery treatment. First-year plants were characterized by a high percentage of yellow trees (Norway more than White Spruce) which could not be correlated with treatment. Trees in depressions and those planted close to native shrubs were generally a healthy green colour. The soil in the better portions of the field was slightly less acid and somewhat higher in available Ca and Mg. In a replicated and randomized set, differences due to treatment were small and not significant.

In (*b*) the 7–10–3 fertilizer in the special experiment produced the highest percentage of green trees the first year, and the largest plants in two years out of four. In one set, 6–10–4 fertilizer resulted in 7- to 10-per-cent. poorer survival. Starter solution favoured growth of White Spruce by 10 to 20 per cent. Norway Spruce showed higher percentage survival and less response to treatment than did White Spruce. *From author's summary.*

11.49. Soil Types

See also *For. Abstr.* 9
(Nos. 66, 71, 142, 146, 644–6).

[73]. 11.49 : 01.2. WILDE, S. A. **Proposed additions to the terminology of forest soil genesis.** *Proc. Soil Sci. Soc. Amer.* 10, 1946 (416–8). [Univ. of Wisconsin.] L.S.

The addition of the following terms is suggested:—*Melanization* (incorporation and infiltration of humus), *melanized soils* (transitional group between podzolic and lateritic soils), *grood soils* (prairie forest soils or degraded black-earth soils), *raw humus rendzinas* (calcareous outcrops or deposits with alkaline raw humus), *alpha-*, *beta-*, and *gamma-gley soils* (shallow, mid-, and deep-gley soils), *deluvial soils* (soils formed on deposits of negative topography), *adumbrative soils* (soils resembling or approaching certain genetic types), *lean mull* (a type deficient in litter and incorporated humus because of a rapid decomposition or the destruction of organic matter), and *crust mor* (a type deficient in organic matter because of a sparse growth of vegetation in boreal regions). *From author's summary.*

[74]. 11.49.5 (47.1) : 12.19.3. PAASIO, I. Zur Kenntnis der Waldhochmoore Mittelfinnlands. **[On the forest bogs of Central Finland.]** *Acta forestalia fennica* 49 (2) (1940), 1942. pp. 41. [G.fi.]

[75]. 11.49.5 (47.1) : 12.19.3. PAASIO, I. Zur pflanzensoziologischen Grundlage der Weissmoortypen. **[On the plant-sociological basis of the treeless bog types.]** *Acta forestalia fennica* 49 (3), (1941) 1942. pp. 84 + 2 tbls. [G.fi.]

[76]. 11.49.5 : 12.19. GALKINA, E. A. Bolotnŷe landshaftŷ i printsipŷ ikh klassifikatsii. **[Wet peatland types and the principles of their classification.]** In *Sbornik Nauchnŷkh Rabot . . . (1941–1943).* Botanicheski Institut im. V. L. Komarova, Leningrad. 1946. pp. 139–56. [Russ.]

[77]. 11.49.6 : 12.26–8 : 56. INDIA AND BURMA. **[Lateri**zation of soil in Teak plantations.]** *For. Res. India Burma*, Pt. 1, [1946?] (86–9).

In deteriorating soils of Teak plantations there is a tendency for sesquioxides to accumulate and silica to leach out. This feature and several topographical and morphological characteristics of the soil profile appear to influence the growth of Teak.

Riverain site appears to influence growth of Teak, by providing easily accessible water and good drainage. On the higher slopes, the quality of the Teak falls, possible owing to poor availability of water. The molecular ratio of silica/sesquioxides appears to be correlated with the quality of the Teak.

The dispersion coefficient tends to be low, especially in the subsoil, as the quality of Teak falls. The soil is soapy to touch and not granular as might be expected in a crumbly soil. This form of agglomeration is peculiar to lateritic and poor-quality soil, and may perhaps be used as an index of suitability for Teak.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

See also *For. Abstr.* 9
(Nos. 210, 245, 247, 461, 523, 686, 690).

[78]. 11.6 : 07.7 (492) : 91.3. NIEVELT, B. F. VAN. Het lysimeter-waarnemingsstation in het provinciaal duinterrein onder Castricum. [**The lysimeter observation station in the provincial dune region below Castricum.**] WECHEL, A. TE. De beteekenis van het lysimeter-waarnemingsstation onder Castricum voor den boschbouw. [**The significance of the lysimeter station below Castricum to forestry.**] *Ned. Boschb.-Tijdschr.* 14 (8), 1941 (369–84; 385–92). [Du.]

[79]. 11.62 : 11.14.3 : 91.3 (47.1). LUKKALA, O. J. Sateen mittauksia erilaisissa metsiköissä. [**Measurements of precipitation in various types of stands.**] *Acta forestalia fennica* 50 (23), 1942. pp. 13. [Fi.g.]

[80]. 11.62 : 11.14.4 : 24.2 : 32.29.2 : 12.25. **Depth of snow is increased by thinning of young Lodgepole Pine.** *Rep. Rocky Mt. For. Range Exp. Sta. 1946*, [1947?] (31–2).

A study has been initiated at the Fraser Experimental Forest in a young Lodgepole Pine (*Pinus contorta* var. *latifolia*] stand, to determine the effects of thinning on winter snow storage, interception and loss of spring and summer precipitation. Thinnings were of two types; (1) the single-tree method, consisting in the selection of the better trees to be retained at a rate of about 625 to the acre, keeping a uniform spacing of 8½ ft. between trees as far as possible; (2) a crop-tree system, consisting in selection of the best trees to be left at a rate of 100 trees to the acre, spaced as nearly as possible at 21 ft. and cutting saplings round each selected tree to a radius of 8 ft. All slash was thrown and lopped so as to lie close to the ground. Measurements on these plots to date include one year's record of winter snow storage before treatment and one year's winter snow storage after treatment; summer net rainfall under the crown canopy and summer net rainfall under crown canopy and slash. Snow storage expressed in inches of water was as follows: control 3·79, crop-tree selection 4·25, single-tree selection 4·52. Summer rainfall as measured in gauges set above the slash was also increased by the thinnings, but there was no appreciable increase in the rain reaching the ground under the slash.

[81]. 11.62.1 : 61 : 11.49.5 (54.5). GORRIE, R. M. **Soil erosion survey and conservation working plans.** *Indian For.* 73 (2), 1947 (65–70). [Soil Conservation Circle, Punjab.] (7th Silvicultural Conference (1946), Dehra Dun.)

Details of the aims and methods employed in an erosion intensity survey of the Uhl River catchment area in 1936. The numerator and denominator system described in *Indian For.* 63, 1937 (218–22) formed the basis of the survey.

[82]. 11.62.11 (54.1) : 38.8. BASU, S. K. **Anti-erosion work in Kalimpong Forest Division.** *Indian For.* 73 (1), 1947 (10–4).

An account of protective work on hill land where erosion had rendered further cultivation impossible. Control measures include fencing against men and animals, construction of check dams and contour drains, and the creation of a ground cover of grasses and other plants. *Maesa montana*, *M. macrophylla*, *Engelhardtia spicata* and *Schima wallichii* come up naturally in three or four years' time as a result of protection, but artificially they are difficult to grow and slow to establish. The hardiest and quickest growing species are *Alnus nepalensis* and *Betula cylindrostachys*. Other species suitable for planting in eroded areas are *Cryptomeria japonica*, *Bucklandia populnea*, *Cupressus cashmeriana* and *Erythrina* spp. Experiments are being made with a large number of other plants, of which the most promising appear to be *Macaranga denticulata*, *Crotontiglium* and *Michelia lanuginosa*.

[83]. 11.62.11 (54.2). CHATURVEDI, M. D. **Treatment of ravines.** *Indian For.* 73 (1), 1947 (36–7).

The author believes that the Jamna ravines were never densely wooded in the past and are never likely to support a dense crop of large timber trees. These ravines induce sheet erosion on the arable areas adjoining them. The onrush of water from fields lying on the high banks cannot be controlled except by the usual anti-erosion measures.

In the case of the *khalas* along the high banks of the Ganges, temporary protection from cattle alone is sufficient to induce natural regeneration of *Dalbergia sissoo* and *Azadirachta*

indica, and afforestation of *khalas* on a large scale is not expected to be difficult.

[84]. 11.62.11 (54.4) : 23.3. HAMILTON, A. P. F. **Chambal ravines reclamation scheme.** *Indian For.* 73 (3), 1947 (99–101).

An afforestation scheme was begun in 1925 with the object of preventing erosion in areas adjoining the Chambal River in Gwalior State and providing firewood, small timber and fodder for the local population, but operations (except for maintenance) ceased in 1929–30 after the reclamation of only 1,283 acres. As regards erosion control, the scheme has proved to be a complete success (except at the extremities of the ravines where control of run-off from the fields is also necessary). The crop is not yet fully mature and up to the present only dead wood and ordinary thinnings have been removed, but these have produced a useful supply of firewood, and it seems probable that a net annual profit will eventually be realized.

Shisham (*Dalbergia sissoo*) has done well in the ravine bottoms, and although it is dying out in some places, it had produced trees of firewood size in 16 to 18 years. Other species which have done quite well are *Tectona grandis*, *Gmelina arborea* and *Prosopsis juliflora*. Results with *Anogeissus pendula*, *Acacia arabica*, *Dendrocalamus strictus* and *Pongamia glabra* have been unsatisfactory.

The author considers that, in general, the scheme has been a success and that further reclamation of the ravine area is fully justified. As there is an acute shortage of firewood in the locality, the production of firewood is as important an object of management as erosion control. *Acacia senegal*, *Melia azedarach*, *Azadirachta indica* and *Butea frondosa* are species deserving trial in the new plantations.

[85]. 11.62.11 (54.5). GLOVER, H. **Erosion in Kangra Valley—its cause and cure.** *Punjab For. Notes* No. 9, 1943. pp. 6 + plates.

[86]. 11.62.11 (56.9) : 05.3. PALESTINE. **Annual report of the activities of the Public Committee for Soil Conservation in Palestine** (2.4.45–31.3.46). [1946.] pp. 14 + maps.

The report on the first year's operation of the Committee also includes an account of its foundation, composition and objectives. Notes are given on visits made to a number of settlements and on the methods recommended in each case for checking or preventing soil erosion.

[87]. 11.62.11 (59.1). THOMPSON, T. S. **Soil erosion and its control in the Shan States, Burma.** [?Forest Department, Rangoon.] 1944. pp. 42.

Consists of two parts: (1) a revised report on a field survey made in 1946 of the Myelat, Southern Shan States, to ascertain the extent of soil erosion, and to examine the possibilities of introducing control measures; and (2) a report on erosion control in the Myelat subsequent to the field survey, and on tours in other eroded areas of the Shan States. Amongst the appendixes is a glossary of Burmese names for a number of trees and other plants.

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Photosynthesis. Sap Flow. Transpiration. Growth Substances*

See also *For. Abstr.* 9 (Nos. 6, 43, 53, 56, 64–5, 98, 101–2, 202–3).

[88]. 12.11.1. CONARD, A. Les mouvements des fluides dans les végétaux. [**The movements of fluids in plants.**] Université libre de Bruxelles. 1947. pp. 48. [F.f.e.] [Jardin expérimental Jean Massart.]

The writer propounds a theory of the circulation of fluids in plants, based on almost purely deductive reasoning. The only original observations recorded were made on wounded Hornbeams. The influence of intensity of light on the flow of water from a wound was measured by noting the number of seconds elapsing between consecutive drops and the effect produced by the passage of clouds over the sun. The shortest interval was 9·8 seconds in full sunlight, and the longest (a few minutes later) was 49·4 seconds during the passage of a cloud. The observations were made for a period of only one hour.

[89]. 12.11.11 : 12.26–8. DUFRÉNOY, J. Propriétés des composés extraits des Anacardiacées. [**Properties of compounds extracted from Anacardiaceae.**] *Rev. int. Bot. appl. Agric. trop.* 26 (287/8), 1946 (571–2). [F.] P.R.

A note on the chemical properties of the irritant juices from *Rhus vernicifera*, *R. toxicodendron* and the pericarp of the Cashew nut (*Anacardium occidentale*).

[90]. 12.11.11 : 12.26–8. MITCHELL, W. **The alkaloids of *Duboisia leichhardtii*.** *J. chem. Soc.* 1944 (480–82). [Cf. *For. Abstr.* 4 (50) and 7 (No. 1965).] L.S.

[91]. 12.11.12 : 12.14.2. VINCENT, L. Remarque sur l'élaboration de chlorophylle par les tissus cambiaux d'arbres cultivés '*in vitro*'. [**Note on the manufacture of chlorophyll by the cambial tissues of trees cultivated *in vitro*.**] *Bull. Soc. bot. France* 92 (4/6), 1945 (84–5). [F.] O.B.D.

The cambial tissue of *Populus nigra*, *Castanea vulgaris*, and, to a less extent, *P. tremula*, showed considerable chlorophyll production; that of *Robinia pseudoacacia*, *Quercus robur*, *Salix caprea*, *S. triandra*, *S. babylonica*, and *Acer platanoides* produced only a very small amount of chlorophyll, while no chlorophyll was produced by the cambial tissue of *Betula alba*.

[92]. 12.11.12 : 12.25. KRAMER, P. J., and CLARK, W. S. **A comparison of photosynthesis in individual Pine needles and entire seedlings at various light intensities.** *Plant Physiol.* 22 (1), 1947 (51–7). O.B.D.

The rates of apparent photosynthesis of individual, fully exposed Loblolly Pine [*Pinus taeda*] needles were measured at various light intensities and a constant temperature of 25° C. Fully exposed Pine needles reached their maximum rate of photosynthesis at about one-third of full sunlight and showed no further increase in rate up to the highest light intensity to which they were exposed, 9,200 fc. Entire Pine seedlings attained their maximum rate of photosynthesis at 9,300 fc. and reached only 60 per cent. of maximum at a light intensity equal to one-third of full sun. It is believed that the relatively low rate of photosynthesis of entire Pine seedlings in the shade results principally from mutual shading of the needles by one another. Because of the arrangement of the needles, there is much more mutual shading in Pine than in hardwood seedlings. *From authors' summary.*

[93]. 12.11.12 : 12.26–8 : 11.11. MARVIN, J. W. **Some factors influencing sap flow in *Acer saccharum* Marsh.** *Abstr.* in *Amer. J. Bot.* 33 (10), 1946 (824). [Univ. of Vermont, Burlington, Vt.] O.B.D.

Small excised stems of *Acer saccharum* were exposed to controlled temperatures of 20° F. to 120° F. and the effect of temperature change on the vessel sap was studied. When frozen stems are warmed and held at a constant temperature, a flow occurs. There is considerable variation between stems in the amount and duration of the flow. After the cessation of flow at a constant temperature or after a temperature decrease, water is absorbed from the cut end. *Fagus*, *Prunus*, *Tilia* and *Populus* absorb water under the conditions which induce a flow of sap from Maple stems.

[94]. 12.11.12 : 12.26–8 : 21.8. BURSTRÖM, H., and KROGH, A. **Bleeding and bud development in *Carpinus*.** *Svensk bot. Tidskr.* 41 (1), 1947 (17–44). [E.e.] O.B.D.

The bleeding of sap from *Carpinus betulus* branches may be explained as an osmotic phenomenon caused by the suction force of the sugars of the sap. The development of the buds starts during the bleeding period but proceeds very slowly as long as the bleeding lasts. As the buds open, the sugar content of the sap decreases, and the bleeding ceases. Shortly thereafter cambial growth sets in. From the dilute sap the buds absorb hexose and mineral nutrients. The latter must be delivered by the sap to the buds from long distances. Sap movements associated with the bleeding are not responsible for this migration of nutrients. *From authors' summary.*

[95]. 12.11.14 : 12.26–8 (68.4) : 21.2. BRUECKNER, A. E. **Transpiration studies of some Natal midlands thornveld trees.** *S. Afr. J. Sci.* 41, 1945 (186–93). [Natal Univ. Coll., Pietermaritzburg.] A.P.B.

An account is given of the transpiration rate of some Natal thornveld trees, measured by the torsion balance method, and of the mathematical test of its reliability. Other experimental methods used are briefly described.

Under conditions of low saturation deficit or plentiful water supply, transpiration rate

reflected the influence of the external factors of the environment and tended to show some relation to leaf water content. Under conditions of high saturation deficit and limited soil water, reduction of transpiration was effected in some cases by stomatal closure; leaf water content remained fairly constant, and was independent of changes in transpiration rate. *From author's summary.*

[96]. 12.11.15. ROL, R. Les hormones végétales: leur applications en matière forestière. **[Plant hormones and their application in forestry.]** *Rev. Eaux. For.* 85 (3), 1947 (150–60). [F.]

A short review of the subject, outlining the progress made to date in the practical use of growth substances in forestry. The short bibliography is composed of French contributions to the subject.

[97]. 12.11.15 : 12.26–8 : 12.11.12. DAGYS, J. Untersuchungen über die Wuchsstoffe des Birkensaftes. **[Investigations on the growth substances in Birch sap.]** *C.R. Lab. Carlsberg* (*Sér. physiol.*) 23 (1), 1940 (1–15). [G.g.] O.R.S.

In a nutrient solution containing biotin, the growth of yeast was markedly increased by the addition of *Betula verrucosa* sap. Autoclaving for one hour at a pressure of 2 atm. increased the effectiveness of the sap 4–5 times. Another growth substance, ineffective for yeast but promoting the growth of *Aspergillus niger*, was found in Birch sap.

12.11.2. *Reproduction. Propagation. Growth. Development*

See also *For. Abstr.* 9 (Nos. 17, 43).

[98]. 12.11.2 : 11.41.1 : 21.3 : 12.14.3 : 11.47.6 : 12.11.15 : 23.23.15 : 12.11.23 : 12.11.22. AALTONEN, V. T. Muutamia kasvukokeita puuntaimilla. **[Some growth trials with tree seedlings.]** *Acta forestalia fennica* 50 (6), 1942. pp. 33. [Fi.g.]

Experiments on: (i) effect of soil temperature on germination and growth; (ii) effects of seedlings upon each other (root competition, density, soil moisture); (iii) "soil fatigue"; (iv) effect of growth substances on germination, seedling growth and cuttings.

[99]. 12.11.21 : 12.11.3 : 11.17. WRIGHT, J. W. **[Pollen dispersal.]** *Rep. Purdue Univ. agric. Exp. Sta.* 1945 (61).

In American Elm [*Ulmus americana*], White Ash [*Fraxinus americana*], and Douglas Fir, 90 per cent. of the pollen shed by a single tree comes to rest within about 2,000 ft., 300–500 ft., and 200–300 ft. respectively. These figures are about the same as those given by European investigators for similar species, but much less than those commonly given in textbooks. This relatively narrow pollen dispersal indicates that in certain circumstances the size of the random breeding unit may be small enough for genetic differentiation to take place in linearly continuous populations of forest trees. In Cottonwood [*Populus* sp.] and Hackberry (*Celtis* sp.] pollen dispersal is too great to make differentiation possible without geographic isolation.

[100]. 12.11.22. STOUTEMYER, V. T., CLOSE, A. W., and O'ROURKE, F. L. **Rooting greenwood cuttings without sunlight under fluorescent lamps.** *Science* 101 (2630), 1945 (546). D.S.I.R.

More rapid rooting of cuttings was obtained in a basement darkroom under continous illumination from a 100-watt Mazda lamp than in a greenhouse. Good results were later obtained with propagation cases of opaque material fitted with a 30-watt fluorescent lamp. Automatic control of the bottom heat was provided by means of a lead-sheathed, soil-heating cable controlled by a thermostat. When lamps of higher wattage were used, cuttings were protected from heat by means of a glass partition. Cuttings tried included various species of *Citrus*, *Cinchona*, *Severinia*, *Hibiscus* and *Bougainvillea*.

[101]. 12.11.22 : 12.11.15. BUGNICOURT, F. Action rhizogène des hétéro-auxines et de certaines vitamines et zoohormones sur quelques plantes d'intérêt économique. **[The action of hetero-auxins and certain vitamins and animal hormones in promoting rooting of some plants of economic interest.]** *Bull. écon. Indochine* fasc. II, 1942. pp. 41. [F.] *Abstr.* in *Rev. int. Bot. appl. Agric. trop.* 26 (289/90), (654–6). P.R.

The author's experiments were made mainly on *Coffea*, *Thea*, *Derris*, *Hevea* and *Cinchona*, using a variety of substances, e.g. hetero-auxins, bios, vitamins, zoohormones, phytohormones,

benzinated water, etc. He attaches great importance to the sterilization of the section of a cutting, and obtained good results from using ortho-oxyquinoline for this purpose.

[102]. 12.11.22 : 12.11.15 : 44.3. DORAN, W. L. **Damping-off and growth of seedlings and cuttings of woody plants as affected by soil treatments and modifications of environment.** *Bull. Mass. agric. Exp. Sta.* No. 428, 1945 (19–20).

Especial attention was given to the effects of combinations of certain fungicides (Spergon, Fermate, Arasan) with root-inducing substances (Hormodin 1 and 2, indolebutyric acid), usually in the proportion of 1 : 1 by volume, for the treatment of cuttings. In general, rooting was better after combined treatment than after treatment with growth substances alone.

[103]. 12.11.22 : 12.25 (94). AUSTRALIA. **[Vegetative reproduction of Monterey Pine.]** *Rep. For. Bur. Aust.* 1946 (5).

New work was concentrated on the development of methods for obtaining a greater percentage strike in the nursery and the production of better root systems. The use of galvanized iron tubes in which the cuttings were struck was found to give promising results. Should the success of initial tests be repeated in the larger experiments planned for 1946, a simple nursery technique for raising Monterey Pine vegetatively and successfully establishing it in plantations may be developed. The first clones raised in the nursery in 1937 and transplanted to plantations in 1938 and 1939 are interesting illustrations of the manner in which vegetative characteristics lead to the wide variations found between trees in a Monterey Pine plantation. The possibility of the use of cuttings to improve the quality and value of Monterey Pine forests is becoming increasingly apparent.

[104]. 12.11.22 : 12.25 : 12.11.3 (485). KIELLANDER, C. L. Om barrträdsförädling och barrträdsympning. **[The breeding and grafting of conifers.]** *Repr.* from *Svensk PappTidn.* Nos. 23 and 24, 1946. pp. 16. [Sw.e.]

A brief, illustrated review of the conifer breeding work in progress at Ekebo and the various branch stations of the Swedish Forest Tree Breeding Association, including a special section describing with explanatory photographs the technique of grafting Norway Spruce, Scots Pine and Larches.

[105]. 12.11.22 : 12.25. SWARTLEY, J. C. **Some grafting methods made easy.** *Amer. Nurserym.* 85 (7), 1947 (7, 8, 68–72).

Notes on methods of grafting Rhododendrons, Hemlock and Spruce, used in a Maryland nursery. An original feature is the covering of the graft union with peat instead of exposing it to the air, which has resulted in 90 per cent. successful grafts.

[106]. 12.11.22 : 12.26–8 : 22.2 (47.1). MIKOLA, P. Koivun vesomisesta ja sen metsänhoidollisesta merkityksestä. **[Coppicing in Birch and its significance in forestry.]** *Acta forestalia fennica* 50 (3), 1942. pp. 102. [Fi.g.]

12.11.3. *Heredity. Breeding. Hybridization. Races and Questions of Provenance. Cytology*

See also *For. Abstr.* 9 (Nos. 17, 99, 104, 201).

[107]. 12.11.3. JOHNSON, L. P. V., and BRADLEY, E. C. **Hybridization technique for forest trees.** *Canad. J. Res.* 24C (6), 1946 (305–7). D.S.I.R.

The relative merits of different materials as coverings to protect receptive female flowers against chance pollination were studied, and a combination of glassine (inner) and kraft (outer) bags was adopted. Pollination was effected as follows: the kraft bag was removed and the glassine bag punctured with the point of a specially designed pollen gun; the pollen was then driven into the bag by squeezing the bulb of the gun; finally, the puncture was sealed with an adhesive patch and the kraft bag replaced. The pollen gun attaches to pollen containers (small Erlenmeyer flasks) that can be stored over calcium chloride. *Authors' summary.*

[108]. 12.11.3 : 12.25–8. JOHNSON, L. P. V., and HEIMBURGER, C. **Preliminary report on interspecific hybridization in forest trees.** *Canad. J. Res.* 24C (6), 1946 (308–12). D.S.I.R.

Interspecific hybridization in various forest tree genera gave the following results: *Populus*, 43 crosses; *Picea*, 12; *Pinus* 4; *Betula*, 14; *Fraxinus*, 5; *Ulmus*, 7; and *Tilia*, 9. The

hybridity of most of these materials has been proved or strongly indicated by various criteria; but for some of the materials, hybridity is assumed on the basis of seedling production under conditions that largely preclude the possibility of self- or chance-pollination. *Authors' summary.*

[109]. 12.11.3 : 12.26–8 : 12.11.22. JOHNSON, L. P. V. **A note on inheritance in F_1 and F_2 hybrids of *Populus alba* L. × *P. grandidentata* Michx.** *Canad. J. Res.* 24C (6), 1946 (315–7). D.S.I.R.

At five years of age, average heights in feet were: *Populus alba*, 14·0; *P. grandidentata*, 11·7; F_1, 17.6; F_2, 9·5. On the basis of an F_2 population of 168 trees, modes of inheritance were assumed for leaf characters as follows: pubescence, four cumulative factors; colour, 1 : 2 : 1 monohybrid ratio; midrib, 42 : 15 : 6 : 1 trihybrid ratio; shape, margin, apex, and base, each inherited on the basis of multiple factors.

The high rooting capacity of *P. alba* (92 per cent.) was transmitted to the F_1 hybrid as a dominant character. It is suggested that *P. alba* is homozygous for one or more highly-determining, dominant alleleles not possessed by *P. grandidentata*. Back-crossing failed to increase the degree of rooting. Comparable results from *P. tremuloides* indicated that this species carries an inhibitor for the *P. alba* rooting factor or factors and is deficient for the rooting factor or factors possessed by *P. grandidentata*. *Author's summary.*

[110]. 12.11.3 : 12.26–8 : 21.8 : 42.21 : 56.01. WETTSTEIN, W. VON. Möglichkeiten der Züchtung neuer Ökotypen nach Kreuzung. **[Possibilities of breeding new ecotypes by hybridization.]** *Züchter* 14 (12), 1942 (282–5). [G.] C.G.B.

In deciduous species, ecotypes of continental or cold regions have greater frost resistance and a shorter growing season, with earlier entry into dormancy. Von Wettstein has repeatedly observed that seedlings of *Populus tremula* from East Prussia and Sweden, cultivated at Müncheberg, turn colour in September, whereas those of western and southern provenance are still green in October. The Swedish giant Aspen ends its growth as early as the beginning of August. F_2 progeny of *P. tremula* × *tremuloides* are 14 days earlier in flushing than native trees [of *P. tremula*?] and are sometimes damaged by late frosts.

In 1938 the growth rates were compared of seedlings of 3 ecotypes and 4 ecotype hybrids within *P. tremula*, and of the hybrids *P. alba* × *tremula* and (*P. tremula* × *tremuloides* F_2) × (*P. tremula* × *tremuloides* F_2). Daily measurements were begun on Aug. 2nd and were continued twice daily (at 6 a.m. and 6 p.m.) for 30 days. Growth took place almost entirely in the daytime. Results are tabulated in detail: they show considerable variation in total height growth, period of maximum height growth, length of growing season and date when growth was completed. The last is particularly important, since it indicates the possibility of producing crosses especially suitable for particular localities, e.g. 3 of the hybrids were more promising than others of higher growth rate for the Müncheberg district, owing to timely lignification of their shoots of the year. Crosses of extremes may well increase heterotic vigour, but also introduce a risk of tenderness by lengthening the growing season to excess. F_2 *P. tremula* × *tremuloides* showed an extension of the growing season by 20 days, with an increment of 21 cm., but in some years lignification is poor and the shoot apices are damaged by frost.

[111]. 12.11.3 : 12.25 (73). **Seed source showings.** *Rep. Lake St. For. Exp. Sta.* 1946 [1947] (10).

Growth and survival at the end of 16 growing seasons showed significant variations among 37 sources of Red Pine [*Pinus resinosa*] and 20 sources of Scots Pine planted in the Superior National Forest in 1931. The 5 most promising sources of Red Pine (considering survival and height and diameter growth) are from north-eastern Minnesota and north-western Wisconsin. The best Scots Pine sources are of central European types (seed collected in central Minnesota, central Wisconsin and Czechoslovakia) and the poorest include both central and northern European types (seed collected in Iowa, New Hampshire, Norway, Sweden, and Austria). Important differences in survival and height growth of various Spruces were shown in an 11-year-old planting in the Nicolet National Forest. Considering both survival and height growth, the most promising lot were White Spruces [*Picea glauca*] from Port Arthur, Douglas and Angus, Ontario, and Norway Spruces [*P. abies*] from 3 Russian sources and of var. *borealis*.

[112]. 12.11.3 : 12.25 (481). TRESCHOW, F. M. Ormgran i Norge. [**The 'Snake' Spruce in Norway.**] *Skogen* 31 (22), 1944 (338). [Sw.]

Cf. *For. Abstr.* 6 (225), where for 'Worm' Spruce read 'Snake' Spruce.

Of 400 plants raised from seed collected in 1922 from a tree—the only one of its kind in the stand—of this peculiar form of Norway Spruce [*Picea abies*], most appeared at 4–5 years of age to be ordinary Norway Spruce and were sold. The remainder (16 plants) were planted out on the author's land, and are still of a pronounced 'Snake' type. Five or six of them are quite typical, with several annual shoots having no lateral shoots whatever, and have therefore stagnated in growth. The rest, though of the 'Snake' type, have formed almost normal leaders of late years and have grown fairly well, the largest being now 10·7 m. high and 21 cm. in d.b.h.

[113]. 12.11.3 : 12.25. ANDERSSON, E. **A case of asyndesis in *Picea abies*.** *Repr.* from *Hereditas, Lund* 33, 1947 (301–47). [E.]

A case of asyndesis in *Picea abies* has been observed. Comparisons are made between meiotic divisions in normal Spruces and those in the asyndetic specimen. Progeny obtained from the asyndetic Spruce after free flowering show varying height growth, growth habit, and stomatal size. The rare occurrence of stabilized polyploid species within the Conifers is discussed, as well as various reasons for the fact that no polyploid tree has been found within *P. abies*. *From author's summary.*

[114]. 12.11.3 : 12.26–8 : 12.14.5. DANSEREAU, P., and DESMARAIS, Y. **Introgression in Sugar Maples—II.** *Amer. Midl. Nat.* 37 (1), 1947 (146–61). [Service de Biogéographie, Université de Montréal.]

The aim of this study was to measure the extent of hybridization between *Acer saccharophorum* and *A. nigrum*, if it was in fact taking place, by means of leaf characters (leaf shape and pubescence). It has already been shown [see *For. Abstr.* 4 (217)] that in Quebec the two species hybridize freely and there is introgression in favour of *A. saccharophorum*. This is confirmed by further studies. Some colonies show many intermediates between the two forms.

[115]. 12.11.3 : 12.26–8. EHRENBERG, C. E. Till frågan: existerar *Alnus glutinosa* × *incana* i naturen? [**On the question: Does *Alnus glutinosa* × *incana* exist in nature?**] *Bot. Notiser, Lund.* No. 4, 1946 (529–35). [Sw.e.] O.B.D.

The almost complete regularity of meiosis in *Alnus glutinosa*, *A. incana*, and intermediate forms (possibly hybrids) growing in the same grove, may be due to one of the following causes: (1) The intermediates may be varieties of the pure species (*A. glutinosa* × *incana* has never been produced artificially); (2) the chromosomes of the parental species may be to a great extent homologous.

[116]. 12.11.3 : 12.26–8. JOHNSSON, H. **Progeny of triploid *Betula verrucosa* Ehr.** *Bot. Notiser, Lund* No. 2, 1946 (285–90). [E.] [Forest Tree Breeding Institute, Ekebo, Källstorp, Sweden.] O.B.D.

Experiments were carried out to test the fertility of triploid × triploid *Betula verrucosa*, triploid *B. verrucosa* × *B. pubescens* (and reciprocal), triploid *B. verrucosa* × diploid *B. verrucosa*, and triploid *B. verrucosa* × a 42-chromosomal individual (probably an F_1 of *B. pubescens* × *verrucosa*). A table is given showing the chromosome numbers and vitality of the progeny of the triploid × triploid cross.

[117]. 12.11.3 : 12.26–8. SAX, H. J., and SAX, K. **The cytogenetics of generic hybrids of *Sorbus*.** *J. Arnold Arbor.* 28 (1), 1947 (137–40 + plate).

Natural hybrids between *Sorbus* and *Aronia* and between *Amelanchier* and *Pyrus* are partially sterile and show considerable meiotic irregularity. *Sorbaronia* produces a variable progeny in both morphological characters and viability. *Amelasorbus* produces few viable seeds and the progeny appear to be of parthenogenetic origin. *Sorbopyrus* sets few seeds and the progeny include many dwarf segregates which survive for only a few years. The cytogenetic analysis indicates a common origin of these genera, but a degree of differentiation sufficient to maintain generic isolation. *Authors' summary.*

12.13. Embryology

[118]. 12.13 : 12.25 : 12.14.7. BUCHHOLZ, J. T. **Volumetric studies of seeds, endosperms, and embryos in *Pinus ponderosa* during embryonic differentiation.** *Bot.*

Gaz. 108 (2), 1946 (232–44). [Univ. of Illinois, Urbana, Ill.] O.B.D.

[119]. 12.13 : 12.25. ALLEN, G. S. **Embryogeny and the development of the apical meristems of *Pseudotsuga*. II. Late embryogeny.** *Amer. J. Bot.* 34 (2), 1947 (73–80). O.B.D.

12.14. Organography. Morphology. Anatomy. Histology

See also *For. Abstr.* 9 (Nos. 48, 289).

[120]. 12.14 : 12.26–8. VYAZOVSKAYA, G. P. Nekotorye dannye po morfologii i anatomii vostochnogo buka—*Fagus orientalis* Lipsky. [**Some data on the morphology and anatomy of Oriental Beech.**] *Sovetsk. Bot.* No. 5/6, 1941 (79–84). [Russ.] [V.M. Molotov University, Rostov-on-Don.] O.B.D.

A detailed account is given of morphological and anatomical differences between the leaves, male flowers, petiole, and pericarp of *Fagus orientalis* and *F. sylvatica*.

[121]. 12.14.1 : 12.14.2 : 12.25. DODD, J. D. **Three dimensional cell shapes of cambial initials in *Pinus silvestris*.** *Abstr.* in *Amer. J. Bot.* 33 (10), 1946 (819–20). [Columbia Univ., New York, N.Y.] O.B.D.

[122]. 12.14.3 : 12.25 (47.9). KRASIL'NIKOV, P. K. Kornevaya sistema kavkazskoy pikhty (*Abies nordmanniana* (Stev.) Spach). [**The root system of *Abies nordmanniana*.**] In *Sbornik Nauchnykh Rabot . . . (1941–43)*. Botanicheski Institut im. V.L. Komarova, Leningrad. 1946. pp. 457–9. [Russ.] [Abstract of thesis.]

This study included trees of all ages, growing in the four chief associations of *A. nordmanniana* in the northern Caucasus, on grey, stony clay-loams over clayey and sandy slates, and on varying slopes and aspects. The methods used were complete excavation, the trench method (Weaver) and Kalinski's 'soil monolith' method with some modifications.

Adult trees had a short tap root (not more than 1–1·5 m.) and a layer of very strongly developed horizontal roots sending vertical anchor roots deep into the soil. The radius of the root system varied from 6 to 9 m. The percentage distribution of roots by soil horizons was as follows:—18·6 at 0–10 cm.; 55 at 10–20 cm.; 16·6 at 20–30 cm.; 6·2 at 30–40 cm.; and 3·6 at 40–50 cm. Below 50 cm. only the tap root and a few anchor roots were found. Lateral roots running down-slope were longer than those running up-slope, and were concentrated in the upper soil horizons. This is characteristic of the species, as *Picea orientalis*, growing under the same conditions, behaved differently. The strong superficial roots of *A. nordmanniana* are much tapered, but taper decreases with increasing gradient. On level ground the projection of the root system is a circle; on slopes it is an ellipse, the long axis of which is in the direction of the slope, and the steeper the slope the more narrowly elliptical is the root system, the main lateral roots running down and across the slope.

In the seedling and early stages, growth of the tap root predominates; with entry into the third storey, at about 50–60 years of age, the tap root thickens and grows more slowly in length, and development of lateral and anchor roots begins; when the tree enters the second storey, the tap root almost stops growing, while the superficial and anchor roots continue to develop strongly; and finally, when crown dominance is achieved at 150–250 years of age, growth of the tap root stops, the laterals often form large root spurs, and the anchor roots penetrate deeper and begin to resemble tap roots.

The study confirmed root competition with upper-storey trees, rather than deficiency of light, as the reason for the dying of trees under forest canopy.

Brief notes are included on the root systems of shrubs and herbs associated with *A. nordmanniana* or invading felled areas.

[123]. 12.14.4 : 12.25 : 12.14.2. STERLING, C. **Sclereid formation in the shoot of *Pseudotsuga taxifolia*.** *Amer. J. Bot.* 34 (1), 1947 (45–52). [Univ. of Illinois, Urbana, Ill.] O.B.D.

[124]. 12.14.7 : 12.25. KUJALA, V. Über die morphologische Deutung des Fichtenzapfens auf Grund eines Fertilisationsfalles. [**On the morphological interpretation of the Spruce cone based on a case of fertilization.**] *Acta forestalia fennica* 50 (7), 1942. pp. 22. [G.fi.]

[125]. 12.14.7. MARTIN, A. C. **The comparative internal morphology of seeds.** *Amer. Midl. Nat.* 36 (3), 1946 (513–660).

In 1938 a beginning was made on a systematic analysis of the gross internal features of seeds, particularly on the embryo and endosperm and their relative size, shape and position, and the study was completed in 1943. The study covered 1,287 genera of plants, largely from the United States, but with considerable representation from other parts of the world. Results of the investigation include a system of seed classification, an outline of seed phylogeny, and an illustrated, classified, and annotated list of the genera analysed.

[126]. 12.14.7 : 12.26–8 (45) : 23.23.1. PHILIPPIS, A. DE., and MAGINI, E. Il riconoscimento dei semi forestali. [**The identification of forest tree seeds.**] *Ital. for. mont.* 2 (2), 1947 (114–9). [It.]

A key for the identification of the commoner Italian hardwood species.

[127]. 12.14.7 : 12.26–8 (82). BOELCKE, O. Estudio morfológico de las semillas de Leguminosas, Mimosoideas y Caesalpinioideas de interés agronómico en la Argentina. [**Morphological study of the seeds of some Leguminosae, Mimosoideae and Caesalpinioideae of interest in Argentine agronomy.**] *Darwiniana* 7 (2), 1946 (240–321 + plates). [Span.] O.B.D.

Includes a key to the identification of seeds and detailed descriptions of the morphology of the seeds of 85 species, viz.: *Acacia* (19 spp.), *Inga* (2), *Enterolobium*, *Calliandra* (2), *Albizzia* (2), *Pithecellobium* (3), *Leucaena*, *Mimosa* (4), *Prosopis* (13), *Adenanthera*, *Neptunia*, *Piptadenia* (4), *Mimozyganthus*, *Copaifera*, *Pterogyne*, *Tamarindus*, *Bauhinia*, *Cercis*, *Apuleja*, *Cassia* (7), *Ceratonia*, *Caesalpinia* (4), *Hoffmanseggia*, *Stenodrepanum*, *Peltophorum*, *Cercidium*, *Parkinsonia*, *Delonix*, *Schizolobium*, *Gleditsia* (2), *Gymnocladus*, *Balsamocarpon*, *Zuccagnia* and *Holocalyx*.

12.19. Geographical Distribution. Plant Geography and Sociology

See also *For. Abstr.* 9 (Nos. 5–6, 17, 165, 330).

[128]. 12.19 : 02.1 : 61. TANSLEY, A. G. **Introduction to plant ecology: a guide for beginners in the study of plant communities.** George Allen & Unwin Ltd., Museum Street, London. 1946. pp. 260. Price 8s. 6d.

The present work is a thoroughly revised version of the author's *Practical Plant Ecology*, originally published in 1923. Not only has the text been brought up to date, but the balance of the book has been to some extent changed. The general exposition of the subject has been added to and strengthened, treating concepts relating to plant communities more fully and defining the plant formation in accordance with *The British Islands and Their Vegetation*; the section on Life Forms has been expanded. The practical side of field ecology is represented by new sections on methods of vegetation survey and photography, but instructions in soil analysis are restricted to rough field tests. There is a bibliography of 14 pages and a few line text-figures but no photographic illustrations.

[129]. 12.19 (45). NEGRI, G. Sulle specie legnose 'isolate' della flora italiana. [**The 'isolated' woody species of the Italian flora.**] *Ital. for. mont.* 1 (3), 1946 (75–93). [It.]

The writer applies Scharfetter's conception of 'isolated species' (*Einarten*) to the woody flora of Italy, listing the species belonging to this category and urging the usefulness of a study of their ecology and distribution as indicators of the conditions of penetration and acclimatization of the more recent plant migrants in this region. The tree species include *Pinus cembra*, *Larix decidua*, *Picea abies*, *Abies alba*, *Taxus baccata*, *Betula alba*, *Alnus minor*, *Ostrya carpinifolia*, *Corylus avellana*, *Castanea sativa*, *Fagus sylvatica*, *Platanus orientalis*, *Olea europaea*.

[130]. 12.19 : 12.25 (469). ROZEIRA, A. A espécie *Pinus pinaster* em Portugal. Nota sôbre a expansão actual em Trás-os-Montes e Alto Douro. [**The species *Pinus pinaster* in Portugal. Note on its present range in Trás-os-Montes and Alto Douro.**] *Bol. Soc. broteriana* 19 (2.ª ser., 2.ª pt.), 1945 (669–73). [Port.] [Instituto de Botânica da Universidade do Pôrto.]

[131]. 12.19 : 12.25 (57.4). DŸLIS, N. V. O yuzhnoy granitse rasprostraneniya sibirskogo kedra na srednem Urale. [**The southern limit of the range of *Pinus sibirica* in the central Urals.**] *Sovetsk. Bot.* 14 (4), 1946 (276–81). [Russ.] [Sverdlov Botanic Garden.] O.B.D.

Pinus sibirica is recorded for the first time from 17 localities in Sverdlovsk Province (Central Urals) between the rivers Chusovaya

and Ufa, growing singly or in small groups in old forest in the most inaccessible parts of the region. The trees varied in age from 30 to 80 years, in height from 7 to 20 m. and in diameter from 10 to 48 cm., and most had well developed cylindrical crowns. Though some bore cones, only in one place were two young trees found. It is believed that the species was formerly commoner in the region and that its present rareness is due to fire and to fellings both for seed collection and for the wood, which was used by bee-keepers. Unless cone-gathering is restricted, the species is likely to disappear from this area. [Cf. *For. Abstr.* 9 (No. 148).]

[132]. 12.19 : 12.26–8 (44). LENOBLE, F., and BROYER, C. Sur la distribution du *Buxus sempervirens* L. en France. **[On the distribution of *Buxus sempervirens* L. in France.]** *Bull. Soc. bot. France* 92 (7/8), 1945 (118–31). [F.] O.B.D.

[133]. 12.19 : 12.26–8 (57.6). RUBTSOV, N. I. Tyan'shanskaya osina. **[The Tian-Shan Aspen.]** *Sovetsk. Bot.* 14 (5), 1946 (333–4). [Russ.] [Kazakh Branch, Academy of Sciences of the U.S.S.R., Alma-Ata.] O.B.D.

It is suggested that *Populus pseudotremula* Rubts. (*P. tremula* var. *tardifolia* Rubts.) is a relict species, and that its depauperate appearance and extremely late foliation are tokens of disharmony with an environment that has changed since it (and associated herbaceous species, also of boreal origin, which appear to be losing ground) first migrated to the Tian Shan.

12.19.1. *Regional Floras, including Check Lists*

See also *For. Abstr.* 9 (No. 41).

[134]. 12.19.1 (71). GARDNER, G. Liste des plantes récoltées sur la côte du Labrador, dans le détroit d'Hudson, à la baie d'Hudson, à la baie James et dans le Manitoba Nord, en 1930, 1932, 1933, 1937, 1938 et 1939. **[List of plants collected on the coast of Labrador, in the Hudson Strait, in Hudson Bay, James Bay and Northern Manitoba, in 1930, 1932, 1933, 1937, 1938 and 1939.]** *Bull. Soc. bot. France* 93 (5/6), 1946 (162–200). [F.] O.B.D.

[135]. 12.19.1 (729.6). STEHLÉ, H., and STEHLÉ, [M.] Liste complementaire des arbres et arbustes des Petites Antilles. **[Supplementary list of the trees and shrubs of the Lesser Antilles.]** *Carib. For.* 8 (2), 1947 (91–123). [F.E.Span.] Cf. *For. Abstr.* 6 (79).

[136]. 12.19.1 (76.3). BROWN, C. A. **Louisiana trees and shrubs.** *Bull. La. For. Comm.* No. 1, 1945, pp. 262.

[137]. 12.19.1 (79.8 : 71.1 : 71.2). ANDERSON, J. P. **Flora of Alaska and adjacent parts of Canada: an illustrated descriptive text of all vascular plants known to occur within the region covered. I. Pteridophyta and Gymnospermae (ferns to conifers). II. Typhaceae to Poaceae. III. Cyperaceae to Orchidaceae. IV. Dicotyledoneae: Salicaceae (except *Salix*) to Caryophyllaceae. V. Cabombaceae to Droseraceae.** *Iowa St. Coll. J. Sci.* 18 (1;4), 1943–44 (137–75; 381–445); 19 (2), 1945 (133–205); 20 (2; 3), 1946 (213–57; 297–347).

[138]. 12.19.1 (902) : 01.6. MERRILL, E. D. **A botanical bibliography of the islands of the Pacific.** *Contr. U.S. nat. Herb.* 30 (1), 1947 (1–322). O.B.D.

The bibliography (which is arranged alphabetically under authors) covers essentially the islands of the Pacific lying between 30° N. and 30° S. (excluding the Bonin Islands), and comprises about 3,850 author entries, the earliest of which is dated 1773. References to cellular cryptogams are included, but papers on plant physiology, genetics, cytology and morphology do not come within the scope of the work. Brief annotations indicate the content of the individual papers.

[139]. 12.19.1 (902) : 01.6. WALKER, E. H. **A subject index to Elmer D. Merrill's 'A botanical bibliography of the islands of the Pacific'.** *Contr. U.S. nat. Herb.* 30 (1), 1947 (323–404). O.B.D.

Includes a general subject index, a regional index, a systematic index, and an index of principal references to geographic names.

12.19.2-3. *Vegetation Types*

See also *For. Abstr.* 9 (Nos. 68, 74–6, 180).

[140]. 12.19.2–3 (410) : 09.2. PEARSALL, W. H., and PENNINGTON, W. (Mrs. T. G. TUTIN). **Ecological history of the English Lake District.** *J. Ecol.* 34 (1), 1947 (137–48).

[141]. 12.19.2–3 (581) : 09.7. LINCHEVSKI, I. A., and PROZOROVSKI, A. V. Osnovnŷe zakonomernosti raspredeleniya rastitel'nosti Afganistana. [**The fundamental regularities in the distribution of the vegetation of Afghanistan.**] In *Sbornik Nauchnŷkh Rabot . . (1941–1943)*. Botanicheski Institut im. V.L. Komarova, Leningrad. 1946. pp. 183–218. [Russ.]

A review (37 refs., Russian and other), including:—(1) A general description of the relief, climate and soils of the country; (2) a more detailed account of the vegetation types (map), with brief notes on the composition of the individual types, grouped under the major types—desert and semi-desert, grassland and woody formations—(8 types of coniferous and 10 of broadleaved forest and various shrub communities); (3) an outline of the four geobotanical regions recognized (with map).

[142]. 12.19.2–3 (66) : 11.49. ROBERTY, G. Les associations végétales de la vallée moyenne du Niger. [**Plant associations of the Middle Niger Valley.**] *Veröffentl. geobot. Inst. Rübel, Zürich* No. 22, 1946. pp. 168. [F.]

The greater part of this monograph consists of detailed descriptions of the principal vegetation types in the region under consideration, to which the author applies a new terminology of his own invention. He recognizes two principle regions, the Sahélian and the Sudanese, with some outposts of the Guinea region. The Sahélian region has two main types, the desert (*Chudealium*) and the semi-desert (*Spinigralium*), the first divided into four associations, the second into eleven. The Sudanese region has three main types, one mesophile (*Augusteum*), one sclerophile (*Afrosaltum*), one zerophile (*Dumosaeptum*), comprising respectively 5, 14, and 27 associations.

The hydrological and pedological bases of this vegetation are analysed in the second part. In general the encroachment of sand favours the Sudanese rather than the Sahélian type of vegetation, and alluvial deposits have the opposite effect. This is explained by the abundant rainfall which encourages the reconstitution of vegetation on wind-blown sand, but initiates the process of laterization on alluvial deposits.

[143]. 12.19.2–3 (67.3) GOSSWEILER, J., and MENDONÇA, F. A. Carta fitogeográfica de Angola. Memória descritiva dos principais tipos de vegetação da colónia determinados pelos seus aspectos fisiográficos e caracteres ecológicos segundo a nomenclatura de Rübel. [**Phytogeographical atlas of Angola. Descriptive report of the main types of vegetation in the colony determined by their physiographical aspects and ecological characters according to the nomenclature of Rübel.**] República Portuguesa: Ministério das Colónias. Edição do Govêrno Geral de Angola. Lisboa. 1939. pp. 242 + plates + folding map. [Port.]

The principal vegetational types of Angola are shown in a folding map (scale 1 : 2,000,000), and a synopsis of the plant associations represented in the map is given in the text and illustrated with photographic plates. A general index and an index of species cited is appended.

[144]. 12.19.2–3 (71.4) : 11.2. VILLENEUVE, G. O. **Relationship between climatic and forest conditions in the Province of Quebec.** *For. québec.* 12 (4), 1947 (291–310). [E.] [Degree thesis, Yale University.]

A description of the principal features is given for each region and section of the adopted forest classification, and the major climatic differences with respect to adjacent regions or sections are examined. Four broad regions are recognized: (1) Tundra, (2) Coniferous Forest, (3) Mixed Forest, (4) Hardwood Forest.

[145]. 12.19.2–3 (81). HORN, E. F. **The grasslands, savanna forests, and dry forests of Brazil.** *Carib. For.* 8 (2), 1947 (135–143). [E.Span.f.]

According to the author, there are three categories of prairie in southern Brazil, pure grassland (*campo limpo*), grassland with scattered shrubs (*campo sujo*), and savanna forests (*campos cerrados*), grassland with low, wide-crowned trees. The origin of these *campos* is to be attributed to edaphic factors. Owing to repeated annual burning many of them are now worthless even for grazing. The only products of commercial value produced by the *campos cerrados* are tanbark from *Stryphnodendron barbatimao*, which contains 35 per cent. of tannin, and rubber from *Hancornia speciosa*. In the north-east of Brazil, between the Gurual and Sao Francisco rivers, are found the *catingas* or dry forests which, in spite of the small size and scattered nature of the trees, furnish many products of commercial value such as the

timber of *Dalbergia cearensis*, *D. variabilis* and that of *Guilandia echinata*, which is used for making violin bows; tan bark from *S. barbatimao* and *Piptadenia macrocarpa*, rubber from *Manihot glaziovii*, wax from leaves of the Carnauba Palm, and oil from the seeds of *Licania rigida*. In the Amazon valley there are two kinds of grassland, those periodically inundated (*campos de várzea*) and those not inundated (*campos firmes*). The name of *campinas* is applied in the Amazon valley to open areas, usually of small size and surrounded by forests, and on sandy and acid soils. The flora of these is entirely different from that of the Amazonian *campos*, consisting of stunted shrubs 1–1½ m. high, lichens and herbaceous species of Eriocaulaceae and *Burmannia*.

12.19.2. *Forest Types*

See also *For. Abstr.* 9 (Nos. 39, 46, 48, 67–8, 157, 634, 691).

[146]. 12.19.2 (41.5) : 12.19.4 : 11.49. McEvoy, T. **The vegetation of Irish native woodland.** *Irish For.* 3 (2), 1946 (84–92).

The main climax types in Ireland are as follows: (*a*) *Oakwoods on acidic soils*—on Old Red Sandstone, Metamorphic, Cambrian, Silurian and granitic rocks. Sessile Oak is always dominant. There are three main subdivisions:—(i) *Vaccinium* type; (ii) *Luzula* type; (iii) Fern type. (*b*) *Woods on calcareous soils*, e.g. limestone and basalt; these soils account for two-thirds of the country but, owing to their greater agricultural value, few natural woods exist on them to-day. There are again three subdivisions:—(i) Oak/Ash on deep soils; (ii) Ash on shallower soils; (iii) Hazel scrub on bare limestone pavements. In addition, there are two more or less permanent types dependent on high water-table in the soil: (*a*) Alder wood, with or without Ash; (*b*) Birch wood. These associations are described in some detail.

[147]. 12.19.2 (47 : 57). Korchagin, A. A. K voprosu o printsipakh klassifikatsii lesnýkh gruppirovok. **[On the question of the principles of classification of forest communities.]** In *Sbornik Nauchnýkh Rabot . . . (1941–1943)*. Botanicheski Institut im. V.L. Komarova, Leningrad. 1946. pp. 121–38. [Russ.]

Korchagin analyses the differences between artificial and natural classifications, with special reference under the latter to the ideal of a 'genetical' system based on the evolution and history of the community. He discusses the question whether the concept of the association should rest on plant-sociological characters or on these plus habitat factors, deciding in favour of the former alone as the basis of major division and listing the characters of chief importance in this connexion. Sukachev's classes of succession and the notion of phylogeny as applied to communities are examined, together with the fundamental reasons for the evolution of communities. Specifically forest classifications, mainly those of Russian authors, are reviewed and particular attention is paid to that of Sukachev, which has been by far the most widely accepted for its simplicity, logical arrangement and practical utility, and which is pronounced to be in the main a sociological classification, though using habitat factors for detailed subdivision, and being to some extent 'genetical'.

Korchagin, while agreeing with Sukachev that a thorough-going 'genetical' classification is probably unattainable, at least for the time being, works out a tentative scheme for the outlines of such a classification. He reviews the postcretaceous history of the northern hemisphere and divides the forest vegetation of the U.S.S.R. into a minimum of 6 'genetic' sub-types, viz.: (1) the Ussuri relict forests; (2) Transcaucasian relict forests; (3) European broadleaved forest; (4) Boreal narrow-leaved deciduous forest; (5) Boreal coniferous forest; (6) Turanian (semi-desert) woodlands. These are subdivided to formations by species, e.g. *Excelsi-Piceeta*, *Schrenkiana-Piceeta*, etc.

Formations are split into subformations by the main species of the lower layers, which are classified for this purpose into 5 evolutionary groups—boreal (e.g. *Oxalis acetosella*, *Maianthemum bifolium*, *Equisetum sylvaticum*, most forest ferns, et al.), nemoral (*Aegopodium podagraria*, *Pulmonaria mollissima*, *Asarum europaeum*, *Asperula odorata*, et al.), sub-arctic (*Betula nana*, *Salix glauca*, possibly some *Cladonia*), tropoboreal (*Vaccinium myrtillus*, *V. vitis-idaea*, *Arctostaphylos uva-ursi*, et al.) and tropo-arctic (*Empetum nigrum*, *Vaccinium uliginosum*)—the sub-formations receiving names such as *Excelsi-Piceeta borealia*, *E.-P. tropoarctica*. Within these, association classes

are distinguished by complexity of structure, e.g. *E.-P. borealia* will include *E.-P. fruticosa*, *E.-P. herbosa*, *E.-P. semifruticulosa*, etc., and association groups by particular species, e.g. the last-named will include *E.-P. myrtillosa*, etc. Associations, finally, would be distinguished by soil moisture, largely as expressed by the moss layer, e.g. *E.-P. myrtilloso-polytrichosum*, etc.: thus each stage would have its own peculiarities of geographical distribution, history, sociology and habitat.

[148]. 12.19.2 (47 : 57) : 12.25 : 2. POVARNITSYN, V. A. Kedrovye lesa S.S.S.R. [**The Siberian Pine forests of the U.S.S.R.**] Sib. lesotekh. Inst. Krasnoyarsk. 1944. pp. 220. 43 figs. *Abstr.* in *Bot. Zh. S.S.S.R.* 31 (5), 1946 (41–4). [Russ.] O.B.D.

A monograph on *Pinus sibirica* (which Russian authors maintain as a species distinct from *P. cembra*), containing detailed accounts of its taxonomy and natural range (from the north-east of Russia in Europe to the Yablonoi range in the Far East), its rôle in the formation of forests, and its ecology, with full descriptions and a genetic classification of the forest types in which it occurs, including data on stocking and regeneration. There is a bibliography of 442 references. [Cf. *For. Abstr.* 9 (No. 131).]

[149]. 12.19.2 (66.5) : 09.7. SCHNELL, R. La forêt montagnarde des massifs quartzitiques du Nimba et du Simandou (Guinée Française). [**The mountain forest of the quartzite massif of Nimba and Simandou (French Guinea).**] *Bull. Soc. bot. France* 92 (7/8), 1945 (175–9). [F.] O.B.D.

[150]. 12.19.2 (66.7) : 12.19.4. FOGGIE, A. **Some ecological observations on a tropical forest type in the Gold Coast.** *J. Ecol.* 34 (1), 1947 (88–106 + chart).

The situation, geology and general climate of the Bobiri Forest Reserve are described and some account is given of the history of the area. The average rainfall is about 152 cm. falling in 120 days, with a dry season of 3 months. A large part of the forest is primary.

The forest type, which covers a very large area of the Gold Coast, passes almost imperceptibly into the rain forest in the south-west and a drier type in the north and east. Its structure is similar to that of the rain forest. Floristically the type is exceptionally rich and mixed; on two strips studied in detail, whose area is only 0·1 ha., 75 species occur in the tree and shrub layers alone, and they belong to 53 genera in 23 families. Of the emergents and dominants, only *Triplochiton scleroxylon* and *Celtis* spp. constitute any appreciable proportion of the whole. Chipp's attempt to divide the Gold Coast closed forest into a climax association and several preclimaxes, by the relative abundance of certain dominants as indicator species, has not been found workable. The evidence so far collected tends to support Aubréville's conclusions that mixed tropical forest is a collection of species of similar ecological requirements which occur in combinations fluctuating from place to place and also in time. If correct, they will set the forester an even greater problem than that created by the multiplicity of species, as he will be unable to assume that the natural regeneration following exploitation will be of like species to the crop exploited. Experiments on natural regeneration in the tropical forest in West Africa are now in progress.

[151]. 12.19.2 (67.6) : 12.19.4. EGGELING, W. J. **Observations on the ecology of the Budongo rain forest, Uganda.** *J. Ecol.* 34 (1), 1947 (20–87 + plates).

The situation, geology and general climate of Budongo forest are described. The mean annual rainfall on the edge of the forest is about 1,500 mm. (59 in.). Brief mention is made of the main biotic factors affecting the area. Until recently man has had a negligible influence on the forest, but elephant and fire play a major part in controlling development. The forest is comparatively young. Although it is spreading, it is unable to colonize pure stands of elephant grass.

The least advanced type of closed forest at Budongo is Colonizing Forest, in which one associes and one consocies are recognized. Colonizing Forest is succeeded by Mixed Forest, and Mixed Forest by Ironwood (*Cynometra alexandri*) Forest, which is the climatic climax. Swamp Forest is regarded as an edaphic climax. Both climaxes are consociations.

An account is given of the methods used to investigate the forest. Floristic composition was studied in eleven sample plots, each 122 m. (400 ft.) square. Structure is illustrated by means of profile diagrams constructed from data from clear-felled plots. Colonizing

Forest is shown to be two-storeyed, Mixed Forest four-storeyed, and Ironwood Forest three-storeyed. The stratification of Ironwood Forest and of Mixed Forest differs only in the fact that in Ironwood Forest the topmost (emergent) layer is composed almost entirely of the same tree (*C. alexandri*) which dominates the main canopy. In Mixed Forest the two top layers are composed of different species. Shrub and herb strata are described. Climbers, epiphytes, parasites and saprophytes are discussed. A description of the forest types is followed by a comparison of Budongo with other forests in Uganda and with rain forests elsewhere in the tropics. The climax type at Budongo is shown to have a close general similarity with consociations described from British Guiana, although fewer understorey species are present. *Author's summary.*

[152]. 12.19.2 (729.4). CURTIS, J. T. **The palo verde forest type near Gonaives, Haiti, and its relation to the surrounding vegetation.** *Carib. For.* 8 (1), 1947 (1–25). [E.Span.e.span.f.] [Univ. of Wisconsin, Madison, Wis.]

The Palo Verde forest type was investigated. It may be described as the *Cercidium-Prosopis* faciation of the *Prosopis-Acacia* association. In many respects it is a transitional community between the Thorn Woodland formation and the Cactus Scrub as described by Beard. *From author's summary.*

[153]. 12.19.2 (78.2). TOLSTEAD, W. L. **Woodlands in northwestern Nebraska.** *Ecology* 28 (2), 1947 (180–8). [Univ. of Nebraska, Lincoln, Neb.]

There are about one million acres of rough, stony land in north-western Nebraska with Ponderosa Pine (*Pinus ponderosa* var. *scopulorum*) varying in density from a few trees per acre to dense groves with as many as 2,000 trees per acre. Most stands are now about 50 years old, the virgin timber having been cut between 1880 and 1900. The ground vegetation under and between the trees is discussed in detail. *From author's summary.*

[154]. 12.19.2 (79.1 : 79.2) : 12.25. WOODBURY, A. M. **Distribution of pigmy conifers in Utah and northeastern Arizona.** *Ecology* 28 (2), 1947 (113–26).

The pigmy community in Utah and north-eastern Arizona ranges in altitude from 3,200 ft. to 8,400 ft., but within these limits there are many discontinuities in the forest, usually occupied by sage brush. The forest consists mainly of *Juniperus utahensis, J. monosperma, J. scopulorum, Pinus monophylla* and *P. edulis.* The community lies mainly within the 10–15 inch precipitation belt, and it is concluded from close study that the lower limits of the type are conditioned by the 15-inch precipitation line; it usually increases upwards in size of individual trees, proportion of crown to root, and density of stand. *From author's summary.*

12.19.4. *Succession*

See also *For. Abstr.* 9 (Nos. 26, 47, 146–8, 150–1, 524, 691).

[155]. 12.19.4. YAROSHENKO, P. D. O smenakh rastitel'nogo pokrova. [**On changes in vegetational cover.**] *Bot. Zh. S.S.S.R.* 31 (5), 1946 (29–40). [Russ.f.] [Botanical Institute of the Armenian S.S.R., Erevan.] O.B.D.

The author distinguishes 5 types of change in vegetation:—(i) seasonal (aspects); (ii) annual (variation from year to year due to meteorological and often temporary causes); (iii) successional (relatively short-term successions on a given area); (iv) historical (long-term succession of coenoses in a given region, e.g. forest successions in the post-glacial period as deduced from pollen analyses, etc.); (v) phylocoenogenetical (the 'phylogeny' of a given community, called 'phylocoenogenesis' by Sukachev).

The three last types, which it is claimed are much confused, and especially the last type, are discussed, and a diagram is given to illustrate a tentative interpretation of the 'phylocoenogenesis' of the major vegetation types—steppe, forest and meadow. A recent paper by Sochava [see *For. Abstr.* 7 (No. 1117)] is commended for its general approach but criticized in some of its details.

[156]. 12.19.4 (47 : 57). TIKHOMIROV, B. A. K filotsenogenezu nekotorykh rastitel'nykh formatsi arkticheskoy Evrazii. [**On the phylocoenogenesis of some plant formations of arctic Eurasia.**] *Bot. Zh. S.S.S.R.* 31 (6), 1946 (27–41). [Russ.e.] [V. L. Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad.] O.B.D.

In extension of previous papers, the author considers the phylocoenogenesis [cf. *For. Abstr.* 9 (No. 155)] of shrubby, suffruticose, lichen and moss formations, viz. the micro-Betuleta and derived lichen, moss and sphagnum-bog types (all regarded as derived by reduction from original layered forest communities), Willow formations (partly of temperate-flood-plain, partly of mountain-tundra origin), suffruticose, lichen and moss formations (all partly of forest and partly of arctic-alpine origin) and bogs and tussock tundras (considered as polar extensions of the boreal bog complexes of the forest zone).

A tabular scheme is presented to show the type of classification adopted: this indicates 3 'development cycles' (forest, mountain-tundra, and Arctic), subdivided into 'vegetation types' (e.g. in the forest cycle there are forest, shrub, suffruticose, grass, moss, sphagnum and lichen types), which are further subdivided into 'fundamental formations' (e.g. *Piceeta obovatae*, *Betuleta nanae*, etc.).

[157]. 12.19.4 (71) : 12.19.2 : 12.26–8. DANSEREAU, P. L'érablière Laurentienne. II Les successions et leurs indicateurs. [**The Maple stands of the Saint Lawrence valley. II. The successions and their characteristics.**] *Canad. J. Res.* 24C (6), 1946 (235–91). [F.f.e.] D.S.I.R.

The climax of succession in the deciduous forest area of the St. Lawrence Valley is the *Aceretum saccharophori laurentianum* in which *Acer saccharophorum* is dominant. Subclimax associations are described summarily in their floristic dominants and their phytosociological rôle. Successions often include a subterminal stage very close to the climax, but in which further evolution is checked by a topographic or micro-climatic cause. These quasiclimaxes and the climax itself are described in some detail as well as the unions that characterize their structure.

The Maple groves where human intervention has taken place or is still active are analysed as an element of the subsere. These disclimaxes are of two types according to whether degradation is due to lumbering or to pasture. Conditions unknown in the prisere are realized here which permit the establishment of new units, according to the capacity of adaptation of species. These associations, facies, unions or biotopes naturally owe their duration to the more or less regular repetition of man's interference. *From author's summary.*

[158]. 12.19.4 : 43 (44). BERNER, L. Feux de collines et végétation. [**Hill fires and vegetation.**] Documents pour les Cartes des Productions végétales (Série: France-Méditerranéenne) 1 (1), 1943. pp. 20. [F.]

The writer gives a brief account of the process of revegetation after a severe fire on the hills near Marseilles and deduces from it that orthodox theories of plant ecology are fallacious. He attacks, in particular the conception of the 'association,' maintaining that what has been taken to be a community is in fact only a chance coincidence in time and space of species which have no other connexion with one another.

12.2. *Special (Systematic) Botany*

12.25. Gymnosperms

See also *For. Abstr.* 9 (No. 289).

[159]. 12.25 : 12.11.3. PODHORSKY, J. Spontanes Auftreten von *Picea excelsa*, lusus *pendula* Jaques et Herincq. [**Spontaneous occurrence [at Zell am See, Pinzgau, Salzburg] of *Picea excelsa* lusus *pendula*.**] *Schweiz. Z. Forstw.* 98 (3), 1947 (121). [G.]

12.26-8. Dicotyledons

[160]. 12.26–8 (67.2). CHEVALIER, A. Sur deux arbres remarquables de la forêt du Gabon. [**On two remarkable trees of the Gabon forest [*Brachystegia fleuryana* and *Walkeria nogo*].**] *C.R. Acad. Sci., Paris* 222 (20), 1946 (1152–4). [F.] [See also *For. Abstr.* 9 (No. 173).] D.S.I.R.

[161]. 12.26–8 (69). PERRIER DE LA BATHIE, H. Révision des Anacardiacées, Burseracées et Icacinacées de Madagascar et des Comores. [**Revision of the Anacardiaceae, Burseraceae and Icacinaceae of Madagascar and the Comoro Islands.**] *Mem. Mus. Hist. nat. Paris* 18, 1944 (243). [F.] *Abstr.* in *Bull. Soc. bot. France* 92 (7/8), 1945 (182). O.B.D.

[162]. 12.26–8 (66). AUBREVILLE, A. Les *Lannea* de l'Afrique occidentale française. [**The *Lanneas* of French West Africa.**] *Agron. Trop.* 1 (3/4), 1946 (125–37). [F.] E.M.B.

The species of *Lannea* found in the savannas of West Africa may be grouped in two series, one series with glabrous, more or less waxy, adult leaves (some local varieties have some degree of pubescence), the other series with tomentose leaves, the tomentum having a special character common to the series; this pubescence may disappear completely in a series adapted to a humid climate. In West Africa the genus consists almost exclusively of light-demanding species belonging to open or sparse formations. *L. welwitschii* is the only forest species. Full details are given of the distribution and vernacular names of all known species in the region, together with plates of *L. fruticosa, humilis, acida, microcarpa, velutina, barteri* and *afzelii*, and an identification key.

[163]. 12.26–8 (85 : 86). BARKLEY, F. A. **Noteworthy plants of South America—III. Specimens of *Mauria*.** *Bull. Torrey bot. Cl.* 74 (1), 1947 (77–80). [Chicago Natural History Museum Herbarium, Chicago, Ill.] O.B.D.

Mauria killipii, M. cuatrescasasii, M. dugandii Barkley, n.spp., and *M. obtusifolia* (Engler) Barkley, n.comb., the first from Peru, the others from Colombia.

[164]. 12.26–8 (7 : 8). MONACHINO, J. **A résumé of the American Carisseae (Apocynaceae).** *Lloydia* 9 (4), 1946 (293–309). P.R.

[165]. 12.26–8 (48) : 12.19. LINDQUIST, B. **On the variation in Scandinavian *Betula verrucosa* Ehrh. with some notes on the *Betula* series *verrucosae* Sukacz.** *Svensk bot. Tidskr.* 41 (1), 1947 (45–80). [E.e.] O.B.D.

The North European forms and their variations are discussed at some length. *B. verrucosa* Ehrh. is divided into two varieties which appear as extreme forms dominating in the White Birch populations within great areas in Eurasia: var. *saxatilis* Lindq. has its chief distribution in Central Europe and in central and southern Russia; the other, var. *lapponica* Lindq., occurs in certain boreal and continental parts of northern Eurasia, where, together with var. *platyphylla* (Sukacz.) Lindq., it probably dominates the White Birch populations. The striking congruence between *B. verrucosa* var. *lapponica* and Sukaczew's species, *B. platyphylla*, as well as the occurrence of intermediate forms between these two Birches have caused the author to reduce the latter to a variety of *B. verrucosa* Ehrh., var. *platyphylla* (Sukacz.) Lindq. As the Scandinavian extreme types in vast areas of northern Europe appear as extreme forms within populations and not as homogeneous, geographically strictly limited types, they are presented here as varieties and not as subspecies.

B. verrucosa is supposed to have migrated into Scandinavia along two routes, the var. *saxatilis* from the south, and the var. *lapponica* from the east and north-east. The separating line between the East Asiastic and the Euro-Siberian White Birches is discussed. The author places *B. kenaica* Evans in the East Asian group. The name of *B. japonica*, earlier generally in use, is rejected. *From author's summary.*

[166]. 12.26–8 (69). HUMBERT, H. Une Diptérocarpacée à Madagascar: *Monotes madagascariensis* nov. sp. [**A Dipterocarp from Madagascar: *Monotes madagascariensis* n.sp.**] *Bull. Soc. bot. France* 91 (7/8), 1944 (149–53). [F.] O.B.D.

[167]. 12.26–8. FERNALD, M. L. **Contributions from the Gray Herbarium of Harvard University—No. CLXII. Identifications and reidentifications of North American plants.** *Rhodora* 48 (571), 1946 (137—62 + plates). O.B.D.

Includes a section on the identity of *Quercus laurifolia* Michx.

[168]. 12.26–8 (48). WEIMARCK, H. De nordiska ekarna. 1. *Quercus robur* subsp. *pedunculata* och subsp. *puberula*. [**The Scandinavian Oaks. 1. *Q. robur* subsp. *pedunculata* and subsp. *puberula*.**] *Bot. Notiser, Lund* No. 1, 1947 (61–78). [Sw.] [Lunds Botaniska Museum] O.B.D.

Stellate and forked hairs are allowed in *Quercus robur*, and the fully fertile forms possessing them (and often classified on this account as *Q. petraea* × *robur*) but resembling *Q. robur* in other respects, are placed under *Q. robur* subsp. *puberula*, which appears to have an eastern distribution (map and list of Scandinavian localities).

Leaf nervation, shape of stigmas and striation of acorns, appear to show stronger correlation with fertility than other characters normally used to distinguish *Q. robur* from *Q. petraea* and the hybrids.

Q. robur subsp. *pedunculata* (which is seldom really glabrous) and several of its forms are also briefly discussed.

[169]. 12.26–8 (8). BURKART, A. Leguminosas nuevas o criticas. **[New or critical Leguminosae.]** *Darwiniana* 7 (2), 1946 (216–39 + plate). [Span.] O.B.D.

New or renamed species and varieties of *Acacia, Pithecellobium, Mimosa, Desmanthus* and *Cassia* from Argentina, Chile, Uruguay, Paraguay and Southern Brazil.

[170]. 12.26–8 (67.6 : 67.8). BRENAN, J. P. M. **Four new species of *Memecylon* from East Tropical Africa.** *Kew Bull.* No. 2, 1946 (89–96).

[171]. 12.26–8. BALL, C. R. **Studying Willows or making new sections in the genus *Salix*.** *Rhodora* 49 (578), 1947 (37–49). [U.S. Department of Agriculture; Extension Service.] O.B.D.

Critical discussion of a paper by Fernald [*Rhodora* 48, 1946 (44)] in which two new sections of the genus *Salix* (*Uva-ursi* and *Argyrocarpae*) are proposed. [Cf. *For. Abstr.* 8 (No. 2345).]

[172]. 12.26–8. BAEHNI, C. Mémoires sur les Sapotacées. II. Le genre *Pouteria*. **[Notes on the Sapotaceae. II. The genus *Pouteria*.]** *Candollea* 9, 1942–43 (147–476). [F.] *Abstr.* in *Bull. Soc. bot. France* 91 (4/6), 1944 (123). O.B.D.

[173]. 12.26–8 (67.2). CHEVALIER, A. Nouvelle Sapotacée du Gabon à graines oléagineuses. **[New Sapotaceous genus of Gabon with oil-yielding seeds.]** *Rev. int. Bot. appl. Agric. trop.* 26 (287/8), 1946 (550–4). [F.] P.R.

Walkeria nogo gen. et sp. nov. [See also *For. Abstr.* 9 (No. 160).]

13. FOREST ZOOLOGY

13.1. *General Zoology*

See also *For. Abstr.* 9 (Nos. 321, 565 *et seq.*).

[174]. 13.15 : 13.2 : 22.8 : 45.3. KOSTER, F. Vogels en hun betrekkingen tot het bosch. **[Birds and their relations to the forest.]** *Ned. Boschb.-Tijdschr.* 17 (1), 1944 (1–16). [Du.]

A rough inventory of the birds of woods on the Schovenhorst estate, Veluwe, gave a total of 52 breeding species. Fourteen species nested in young, mainly coniferous woods up to about 15 years old; only 8 species in pure Scots Pine about 35 years old; nearly 40 species in 50-year-old, and about 45 species in 80 to 100-year-old mixed, mainly coniferous forest.

The author agrees with T. C. Oudeman's view that any considerable increase in the permanent bird population depends on the establishment of mixed forest, preferably of hardwoods. The planting of berry-bearing shrubs and small trees is also strongly recommended.

[175]. 13.15 (77.3). COLE, L. C. **A study of the cryptozoa of an Illinois woodland.** *Ecol. Monogr.* 16 (1), 1946 (*sic*, 1947) (49–86).

[176]. 13.15 : 13.2 : 13.12 : 13.11 : 91.4 : 45.3. STEINHAUS, E. A. **Insect microbiology: an account of the microbes associated with insects and ticks with special reference to the biologic relationships involved.** Comstock Publishing Company, Inc., Ithaca, New York. 1946. pp. x + 763. [Univ. of California, Berkeley, Calif.] Price $7.75 (42s.).

[177]. 13.15 : 13.2 : 12.21. PEKLO, J. **Symbiosis of *Azotobacter* with insects.** *Nature, Lond.* 158 (4022), 1946 (795–6). [Phytopathological Institute, Prague.]

Larvae of *Ips typographus* and *Eccoptogaster rugulosus* show a state of *Azotobacter* symbiosis. The bacterium (*A. sulci*, n.sp.) is believed to procure for the insects free nitrogen from the air for the synthesis of proteins.

[178]. 13.15 : 13.2 : 43.1–5 : 45.3. HÖLLDOBLER, K. Über den Nutzen der roten Waldameise. **[On the usefulness of *Formica rufa*.]** *Z. angew. Ent.* 29, 1942 (518–28). [G.]

After reviewing much that has been published on *Formica rufa* and its races, it is concluded that its great utility in forests is fully established and that it should be still further protected and propagated in Germany.

[179]. 13.15 : 15.2 (47.1 : 47.2). HÖLLDOBLER, K. Über die forstlich wichtigten Ameisen des nordostkarelischen Urwaldes. **[On [the biology of] ants important to forestry in the virgin forest of northeastern Karelia.]** *Z. angew. Ent.* 30, 1944 (587–622). [G.g.]

[180]. 13.15 : 13.2 (492) : 12.19. QUISPEL, A. De verspreiding van de mierenfauna in het Nationale Park De Hoge Veluwe. [**The distribution of the ant fauna in the 'De Hoge Veluwe' National Park.**] *Ned. Boschb.-Tijdschr.* 14 (5; 6), 1941 (183–201; 258–86). [Du.e.g.]

Every vegetation type appeared to have its characteristic ant fauna: on sand dunes (*Corynephoretum canescentis*), *Tetramorium caespitum* was the most abundant; on dry heathland, where the total number of nests was very great, *Lasius alienus* was dominant; in Pine woods there were very few nests, and *Myrmica ruginodis* was the most generally distributed species, though it appeared to be dependent upon the presence of ground vegetation, *Vaccinium myrtillus* and Oak seedlings being favourable. Oak woods had a rich ant fauna: poor Oak woods with little or no ground vegetation were characterized by *M. ruginodis*, *Formica fusca* and *Lasius niger* (the last-named being confined to this type), whereas good Oak woods with abundant ground vegetation showed overwhelming numbers of *Myrmica ruginodis*—up to 42 nests on an area of 100 sq.m. Some data are also included on lesser areas of other types, e.g. moist heathland and American Oak [*Quercus borealis*] plantation, and the distribution of each ant species is discussed.

A special study was made of nests of and paths used by *Formica rufa* vars. *polyctena* and *piniphila*, and *F. pratensis*. It appeared that aphids are visited particularly on *Quercus robur*, to a lesser extent on *Picea abies*, *Pinus sylvestris* and *Betula verrucosa*, and hardly ever on *Q. borealis*. *Formica rufa* var. *polyctena* is distinguished from var. *piniphila* and *F. pratensis* by its greater tendency to make colonies consisting of several nests. Eleven sketch-maps are provided to illustrate this part of the study.

13.2. *Special (Systematic) Zoology*

[181]. 13.2 (75.6) : 45.3 : 31.42.1. BEAL, J. A., and MASSEY, C. L. **Bark beetles and ambrosia beetles** (*Coleoptera: Scolytoidea*): **with special reference to species occurring in North Carolina.** *Bull. Duke Univ. Sch. For.* No. 10, 1945. pp. viii + 178 + plates.

Includes sections on life history and habits; economic importance; types of injury; factors affecting bark-beetle abundance; the interrelation of bark-beetles and fungi; control; types of tunnels; key to the galleries of the genera of bark-beetles; taxonomic history; key to families, subfamilies and genera; classification and discussion of species; bibliography; host index.

[182]. 13.2 (485). NORDSTRÖM, F., WAHLGREN, E., and TULLGREN, A. Svenska fjärilar. Systematisk bearbetning av Sveriges storfjärilar. [**Swedish butterflies and moths. A systematic treatment of the macrolepidoptera of Sweden.**] Nordisk Familjeboks Förlags A.-B., Stockholm. 1941. pp. 86 + 354 + 50 plates. [Sw.] Price [£10 10s. 0d.]

This work is intended to replace C. Aurivillius' *Nordens Fjärilar* (1888–91). Part I (86 pp.) includes a general account of the morphology and biology of butterflies and moths, a discussion of the distribution and origin of the Swedish macrolepidoptera, notes on collecting, rearing, etc., keys (for both adult and larval forms) to families, and a bibliography of the most important literature. Part II (354 pp.) consists of keys, descriptions, and 50 handsome coloured plates from original paintings by David Ljungdahl.

2. SILVICULTURE

[183]. 2 : 02.1. FANKHAUSER, F. Economie forestière: guide pratique. [**Practical guide to silviculture.**] Payot, Lausanne. 4th French ed. (translated from 11th German ed.), 1946. pp. 388. [F.] Price 11 Swiss francs (16s. 6d.).

[184]. 2 (45) : 09 : 22 : 23 : 21.0 : 97. PAVARI, A. Orientamenti e problemi della selvicoltura italiana. [**Situation and problems of Italian silviculture.**] *Repr.* from *Atti del Convegno agrario Italo-Americano.* 1946. pp. 26. [It.]

The principal technical problems to be solved by foresters in Italy are: (1) to increase the quantity and improve the quality of production of existing forests; (2) to afforest waste land, scrubland, and land otherwise unsuitable

for agriculture; and (3) to increase wood production outside the forests, i.e. in orchards, plantations, etc. The forest area consists roughly of 1,850,000 ha. of high forest, 500,000 ha. of Chestnut groves, 200,000 ha. of coppice with standards, and 3,050,000 ha. of coppice. Of the area of high forest, 1,170,000 ha. are coniferous, and more than a million of these are in the Alpine region, consisting mainly of Spruce, Larch, Scots Pine, and Silver Fir. Of the 680,000 ha. of broadleaved forest, about 350,000 ha. are Beech, 240,000 deciduous Oak (*Quercus robur*, *Q. sessiliflora*, *Q. cerris*), and 90,000 ha. evergreen Oak (*Q. ilex* and *Q. suber*).

The predominantly Spruce stands in the Alps are managed on a system of group and irregular shelterwood cuttings, and the writer recommends that this method should be continued for the present, but that the strict selection system, as practised in Switzerland, should be gradually introduced. At the present time the annual production per ha. of Italian alpine stands of Fir is only 2·5 cu.m., whereas in Switzerland on similar sites production has been increased within a few decades from 2·3–5 to 6 or even 8 cu.m., per ha. The next most important forest type is probably the Beech stands of the Appenines. It is often recommended that these should be gradually converted to Fir, but in view of the increasing industrial utilization of Beech, the author suggests that conversion should be applied only to degraded stands and that even then the objective should be mixed Beech/Fir. Some of the Oak forests are in good condition but most of them are poor, with degraded soil, as a result of excessive exploitation (especially for railway sleepers), fire, and grazing. It is recommended that the scrub areas of *Quercus sessiliflora* should be gradually converted to management as coppice with standards. This is particularly urgent for the Oak forests of Central Italy which are an essential factor in the agricultural and stock-raising industries, for which they furnish wood, acorns, pasture, green fodder and litter. For these purposes, coppice with standards is the most suitable system. This would, however, necessitate a strict limitation of grazing, particularly by sheep. The Cork Oak forests of Sardinia, and the Chestnut groves which play so important a part in the feeding of the nation, are both endangered, the one by over-exploitation and lack of regeneration, and the other by disease (*Endothia parasitica*). Research is urgently needed on both these problems.

About 53 per cent. of the forested area of Italy is occupied by coppice (including coppice with standards, 56 per cent.). It has often been suggested that much of this should be converted to high forest. The author holds that this should be done only to a limited extent and very slowly, and that coppice should retain an important place in Italian forestry, for the following reasons: (1) its importance as a source of fuel, especially for rural districts and small towns; (2) the impossibility of producing sawtimber economically on many mountain sites; (3) lack of soil fertility on many sites; (4) the close connexion between coppice woods and the agricultural economy, by the production of wood products for such crops as the vine, citrus fruits, tobacco, vegetables, etc., which need large amounts for packing, as well as for the actual process of cultivation; (5) the larger amount of employment given in tending and harvesting coppice growth, an important consideration in such a very heavily populated country; (6) the importance of coppice woodland in providing employment for agricultural workers and transport during the winter; (7) the favourable influence of the Mediterranean climate on the production of coppice woodlands, which equals and often exceeds that of high forest. In spite of the great extent of degraded coppice, the average annual increment of Italian coppice woodland is about 3 cu.m. per ha. compared with about 1·5 cu.m. for high forest, while the maximum (for Chestnut coppice) is 12–15 or even 20 cu.m. per ha.

For reforestation it is necessary to consider the claims of various exotics which often give more rapid production than indigenous species. An example is the planting of the boulder-strewn flood plain of the Rio Leni torrent in Cagliari Province. In 1924–25 this was sown with various Australian species of *Ancacia* (*A. pycantha*, *A. mollissima*, *A. melanoxylon*) and planted with Eucalypts (mainly *E. rostrata* and *E. globulus*). After only 10 years the planted area was covered by a vigorous growth of Eucalypts with an average height of 12–15 m. A part of this was clear felled in 1941 (at 16 years of age) and produced a volume of wood equivalent to 469 cu.m. per ha., representing an average annual increment

of 25 cu.m. In Lombardy, successful experiments have been made with Red Oak (*Q. borealis*), which grows more rapidly than the local race of *Q. robur* and is not subject to Oak mildew. On acid soils in Upper Lombardy, planted at a rate of 500–800 per ha., it yields a volume of 500–600 cu.m. per ha. Managed as coppice on a rotation of 15–16 years, it gives an annual increment of more than 9 cu.m. per ha., or more than double that of *Q. robur*. In the same region, experimental plantings of *Pinus strobus* and *Larix leptolepis* promise well. Experimental areas of Douglas Fir in the Appenines show that this species may produce in 50 years a volume equivalent to that produced by Silver Fir in 100 years.

[185]. 2 : 12.25 (41.5) : 31.8. CLEAR, T. **The production of high grade softwood timber in Ireland.** *Irish For.* 3 (2), 1946 (75–83).

The principal defects of Irish-grown softwoods are knots, excessive ring width, and relative immaturity. Measures recommended for control of these defects are close planting and early and frequent light thinning. The best timber is often produced by co-dominants or 'half-shade' trees, the result of beating up. Early live-pruning is recommended for these.

[186]. 2 : 12.26–8 (492) : 31.0 : 47. HOUTZAGERS, G., *et al.* Handboek voor de populieren-teelt. [**Handbook of Poplar growing.**] H. Veenman & Zonen. Wageningen. 1941. pp. 231. [Du.]

This well illustrated handbook is a symposium of contributions by specialists. Dr. G. Houtzagers deals with the systematic botany of the species commonly grown in Holland (pp. 9–74); E. Teerink contributes a comprehensive account of their silviculture (pp. 75–130); injuries, diseases and pests (pp. 131–206) are covered in separate contributions by M. de Koning, Dr. H. C. Koning, Dr. H. van Vloten, and Prof. J. Westerdijk; wood technology (pp. 207–24) by Dr. H. Broese van Groenou and Prof. A. te Wechel; and control of the botanical identity and health of planting stock (pp. 255–8) by Dr. G. Houtzagers. There is no index, but a rather full table of contents is provided. [Cf. *For. Abstr.* 9 (No. 236).]

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

[187]. 21 : 12.26–8 (69) : 23.23.19 : 31.0. KING, H. C. **Interim report on indigenous species in Mauritius.** Forest Department, Mauritius. 1946. pp. 21.

The main conditions needed for propagation of indigenous species are (1) side shelter from wind, (2) relative freedom from the root competition of exotic weeds, (3) protection from deer. The exposed situation of the island and frequent cyclones have led to the development of a peculiar flora. When once disturbed by man or by the invasion of exotic scrub it can be restored only with great difficulty, if at all. The xeromorphic characteristics common to many species are a low or medium crown, buttressed roots, and small leathery or coriaceous leaves persisting for many years; slow growth and hard timber are normal features. The root system is shallow, with no well developed tap root, but strong surface roots ensure a high degree of resistance to cyclones. Part II of this report contains (1) a provisional key for identifying some mountain forest trees; (2) descriptive sheets for the following species: *Protium obtusifolium, Canarium mauritanium, Elaeodendron orientale, Terminalia angustifolia, Antidesma madagascarensis, Aphloia theaeformis, Antirrhoea verticillata, Calvaria major, Calophyllum inophyllum*; (3) germination period of some indigenous species. (pp. 1–2, 9–21).

[188]. 21 : 12.26–8 (82) : 31.0 : 09.7. ALFONSO, J. L. Forestales indigenas de la Argentina. [**Indigenous forest trees of Argentina.**] Editorial Suelo Argentino, Colle Doblas 955, Buenos Aires. *Colleccion Agro* 11, 1943. pp. 177. [Span.]

The genera represented in the present volume, which is the first of a series, are *Prosopis, Caesalpinia, Bulnesia, Astronium, Schinopsis, Aspidosperma, Jacaranda*, and *Tabebuia*.

[189]. 21 : 12.26–8 : 23.2 : 31.0 : 56 : 76.1 : 45.3. MARTIN, R. R. Contribución al estudo del cedro misionero. [**Contribution to the study of *Cedrela fissilis* Vell., var. *macrocarpa* C.DC.**] *Publ. misc. Direcc. Inform. Argentina* No. 232, 1946. pp. 19. [Span.]

Includes notes on the silvicultural requirements of the tree, growth statistics, the properties and uses of the wood, artificial regeneration, insect pests (mainly *Hypsipyla grandella*), and production costs.

[190]. 21 : 12.26–8 : 31.0. STOFFEL, B. *Robinia pseudacacia* als boschboom. [***Robinia pseudoacacia* as a forest tree.**] *Ned. Boschb.-Tijdschr.* 15 (4), 1942 (171–2). [Du.]

Stoffel quotes an article by C. F. Kaiser (in *Dtsch. Holz-Anz.* Feb. 28th, 1942) in praise of Robinia as a forest tree, especially for light sandy and poor soils, and confirms Kaiser's remarks from his own experience. In Holland Robinia should be used chiefly as an auxiliary species, preferably raised by direct sowing. With good tending it will yield, in 30–40 years, timber that is much in demand for any purpose in which wood of good strength and natural durability (Robinia is more rot-resistant than Oak) is desired. Large dimensions of Robinia will fetch better prices than other sawtimber species in Holland. In nurseries, growth lasts long into the autumn and leaders freeze in hard winters; this trouble is less likely with direct sowings. The greatest difficulty is damage by rabbits, deer and hares, which are fond of the bark; seedlings should be protected with wire netting, and young trees can be wrapped to a height of 75 cm. with tarred paper or the like. Robinia needs careful tending, but the costs of this are worth while in view of the prices paid for its timber.

21.0. *Adaptability to the General Environment. Acclimatization*

See also *For. Abstr.* 9 (Nos. 201, 218).

[191]. 21.0 (410) : 12.25 : 21.7 : 45.3 : 13.2. DUGUID, J. D. **Notes on forestry in the Isle of Man.** *Scot. For. J.* 60 (2), 1946 (77–85).

Notes are given on the relative merits of the various species planted by the Forestry Commission. An essential quality is good wind-resistance, and in this respect *Pinus radiata* and *Picea sitchensis* are particularly satisfactory. *P. radiata* makes remarkable growth, 3–5 ft. height per annum being not uncommon. *P. contorta* and *P. contorta* var. *murrayana* (= *latifolia*) are also very successful on the poorer soils and open exposures—on richer soils they tend to become topheavy and suffer from broken leaders.

An account is given of an outbreak of *Diprion sertifer* in a mixed plantation. Damage to Spruces, Larches and Silver Firs was negligible; that to Pines was more severe, particularly in the older trees which had formed a closed canopy. *P. contorta* was more severely attacked than any other species, and damage to bark was practically confined to this species.

[192]. 21.0 (44) : 12.26–8. CHABANNES, CTE. DE. Acclimatement d'arbres exotiques en France. [**Acclimatization of exotic trees in France.**] *Rev. int. Bot. appl. Agric. trop.* 25 (275/6), 1945 (111–113). [F.]

A note on the satisfactory performance of several American species of Oak (*Quercus rubra*, *Q. coccinea*, *Q. velutina*) on dry, sandy soils in the Sologne, where *Q. robur* does not do well. In addition to their vigorous growth, these species are very frost-hardy and appear to be unaffected by spring frosts which cut back the native species.

[193]. 21.0 (46) : 12.26–8 : 21.6 : 57 : 34.26 : 21 : 22. BURGERS, P. H. Opstandsdichtheid in Eucalyptusbosch. [**Stand density in Eucalyptus plantations [in Spain].**] *Ned. Boschb.-Tijdschr.* 15 (1), 1942 (5–9). [Du.]

In the author's Eucalypt plantations in southern Spain, self-thinning in the first 10 years after planting reduced the number of trees per ha. from 625 (initial spacing 4 m.) to an average of about 380, but this had little effect on the yield capacity, as the loss was largely compensated by the increment of the remaining trees. On a neighbouring estate a plantation of the same initial spacing was felled in 1927 at 23 years of age. No measurements were recorded, but the yield is believed to have been between 100 and 140 cu.m. per ha. The next (coppice) crop was measured on felling in 1941, when only 177 living stumps per ha. remained from the original planting, but these carried 625 coppice stems averaging 25 cm. in d.b.h., 28 m. in height and 0·56 cu.m. in volume, giving a total volume of 409 cu.m. per ha. in 14 years. As a result of his own experiments, the author abandoned clear fellings at 10 years of age in favour of leaving 40–50 per cent. of the best stems, which later (when 15 years old) fetch much higher prices as sawtimber and telegraph poles. In the dry climate of this region, two-storeyed forest has

the advantage over clear felling of retaining more moisture. Young trees are pruned to half their height at 4 years of age, and sometimes again at 7–8 years. When fellings are made, leaves are gathered and the coppice shoots are thinned, also furnishing leaves for oil distillation. By doubling the area worked over, the two-storey system makes it possible for retorts to be stationary and for a larger number of retorts to be operated. The appearance of natural regeneration of *E. globulus*, an apparently unprecedented phenomenon in this region, is attributed to the system of working in combination with a sandy soil. Most of the timber is burnt for charcoal, but some mine timber is also sold. In the nursery, seedlings of *E. globulus* are protected from sun scorch by a straw covering; natural regeneration is sufficiently protected by the over-wood, felling debris, etc.

[194]. 21.0 (46) : 12.26–8 : 56 : 21.8. BURGERS, P. H. Iets over den groei van *Eucalyptus globulus*. [**Note on the growth of *Eucalyptus globulus*.**] *Ned. Boschb.-Tijdschr.* 14 (12), 1941 (585–7). [Du.]

In Andalusia, both *Eucalyptus globulus* and *Pinus pinea* show little or no diameter growth in Dec.-Jan. (low temperatures) and in Aug.-Sept. (low rainfall), but make vigorous growth in the two intervening periods. Monthly basal-area increment, rainfall, and temperature, are tabulated for a two-year period.

[195]. 21.0 (46) : 23.3. BURGERS, P. H. Onderzoek naar de geschiktheid van houtsoorten voor aanvulling van een boschbedrijf in Andalusië. [**Experiments on the suitability of tree species for a forest estate in Andalusia.**] *Ned. Boschb.-Tijdschr.* 16 (1), 1943 (10–25). [Du.]

Eucalyptus globulus, the species originally selected for the author's plantations in Andalusia, did well on 60 per cent. of the area available but was a partial or complete failure on the remainder. The successful plantations occurred only on sites carrying a definite plant association, the *Helianthemetum halimifolii*. Some data are included on this and other associations, and on the climate of the region. The bulk of the paper is devoted to notes on the growth of 148 of the 300 and more species tried in the area since 1929. Of these, *Eucalyptus rostrata*, *E. rudis*, *E. robusta*, *E. botryoides*, and *Pinus pinea*, are valuable for the areas where *E. globulus* fails, and other probably useful species are *Eucalyptus algeriensis*, *E. macarthuri*, *E. viminalis*, *E. maidenii* and various species of *Acacia*.

[196]. 21.0 (46) : 12.26–8 : 22.2 : 57 : 63 : 66 : 76. BURGERS, T. F. Bedrijfsregeling en financieele omloop bij hakhoutbosch van *Eucalyptus globulus*. [**Yield regulation and financial rotation in coppice forest of *Eucalyptus globulus* [in Andalusia].**] *Ned. Boschb.-Tijdschr.* 16 (6), 1943 (248–56). [Du.]

This further article on the Eucalypt plantations of the 'Forestal de Villarejo', Huelva, Andalusia [cf. preceding abstract], includes a provisional local yield table for *E. globulus*, for which the financial rotation is calculated as 52 years or four 13-year felling cycles. The calculation shows a considerable entrepreneur's gain (about 36 pesetas per ha. per annum, based on wages and prices of January, 1943). Data are included on actual as compared with normal growing stock, and on the cost price per cu.m. of timber on the stump. It is unknown whether yields from a second rotation of pure Eucalypt would be satisfactory, but probably a change of crop will be desirable when the first rotation is completed. It will then be necessary either to extend the estate's forest area or to replace *E. globulus* by other species suited to more intensive management.

[197]. 21.0 (46) : 12.26–8 : 22 : 89 : 73 : 76. BURGERS, P. H. Onderzoek naar de zekerheid van geldbelegging in het boschbedrijf 'Forestal de Villarejo'. [**The security of investment in the "Forestal de Villarejo" estate.**] *Ned. Boschb.-Tijdschr.* 14 (7), 1941 (325–41). [Du.]

Cf. preceding abstracts and *For. Abstr.* 9 (No. 459).

[198]. 21.0 (66.9) : 12.26–8 : 22.2 : 33.7 (66.9). **Fuel plantations in Nigeria.** *Rep. For. Adm. Nigeria 1945-46*, 1947 (14).

The use of fast-growing exotics continues to be the rule in short-rotation coppice plantations. Teak is the most successful fuel and pole crop on good soils where there is an adequate rainfall. *Cassia siamea* has been too extensively planted; after making a spectacular start on poor soils, it often fails to produce a crop of any value. *Gmelina arborea*, which was formerly regarded with disfavour, is now accepted as a useful fuel; its strong and rapid

growth and suppression of weeds are useful qualities. *Azadirachta indica* continues to do well on the sandy soils in the north, though it is difficult to establish in the arid regions unless watered in its first two dry seasons; natural regeneration from established trees is plentiful. The most successful species in the mountain grasslands are *Eucalyptus rostrata* and *maidenii* and *Cupressus macrocarpa*. A one-acre sample plot of 10-year-old *E. rostrata* yielded 62 cords of firewood.

[199]. 21.0 (86) : 12.26–8. WIGGINS, I. L. **The Australian Blue Gum (*Eucalyptus globulus* Labill.) in Ecuador.** *Lloydia* 9 (4), 1946 (310–4). [Stanford Univ., Calif.] P.R.

Eucalyptus globulus grows well in all parts of Ecuador at elevations of about 6,000 to 10,000 ft. and with rainfall from 25 to 200 cm. per annum. Its leaves, twigs and wood provide fuel for local needs, and its timber, although showing a strong tendency to warp, shrink and crack, helps to meet the local demand.

[200]. 21.0 (92 : 213) : 11.14.2 : 23.3 : 34.2 : 42.22. ENDERT, F. H. Droogte resistente gewassen. [**Drought-resistant crops.**] *Tectona* 36 (4), 1946 (165–214). [Du.e.]

Intended as a summary of available information for the benefit of all interested in plant introduction to and the economic development of dry areas in Indonesia (particularly Timor), this paper has main chapters on: (i) The term "drought-resistant"; adaptations to dry conditions. (ii) Classification of tropical rain climates. (iii) Location and vegetation of monsoon and savanna regions in Indonesia. (iv) Possible sources of crops for introduction to Indonesian savannas. (v) Some important plant families of tropical and subtropical dry regions. (vi) Lists of economic species suitable for dry regions in Indonesia—(*a*) domestic food crops; (*b*) fruits and nuts; (*c*) fodder crops; (*d*) green manures, cover crops, plants for eroded ground, firebreaks, etc.; (*e*) timber trees; (*f*) commercial crops (fibres, foods and fodders, medicinal plants, insecticides, oils, waxes, gums, resins, tanstuffs and dyes). Notes and suggestions are appended on the organization of trials in the Dutch East Indies. There is an index to the species dealt with, under botanical and other names.

21.1. *Light and Temperature Requirements*

[201]. 21.12 : 12.26–8 : 12.11.3. CHEVALIER, A. Un *Eucalyptus* résistant au froid venu probablement par mutation. [**A cold-resistant Eucalypt produced probably by mutation.**] *Rev. int. Bot. appl. Agric. trop.* 26 (283/284), 1946 (232–4). [F.] P.R.

A tree which appeared about 20 years ago in sowings of locally grown seed at the Parc de la Fauconnière, near Cherbourg, was apparently killed by frost in the winter of 1929, but in the following spring put out two basal shoots which developed into two flourishing trees. One was cut by the Germans, the other survives and is about 15 m. high and 99 cm. in girth at 1 m. above ground level. For some 10 years this tree has given vigorous natural seedlings which have suffered no frost damage in the recent severe winters. It is surmised that a bud mutation took place in the frost of 1929. The new form is named *E. coccifera* var. *favieri* n. var. and morphological differences from type are noted. It grows near the sea on dry, siliceous, heathy ground and might well be worth trying for coast afforestation in N.W. France.

21.3. *Soil Requirements*

See also *For. Abstr.* 9 (Nos. 98, 214, 645).

[202]. 21.32 : 12.11.11 : 11.42 : 12.11.12. BARD, G. F. **The mineral nutrient content of the foliage of forest trees on three soil types of varying limestone content.** *Proc. Soil Sci. Soc. Amer. 1945* 10, 1946 (419–22). [Cornell Univ., Ithaca, N.Y.] L.S.

The mineral nutrient content of the leaves of the native forest trees growing on three New York soil types varying in limestone content was studied and an attempt was made in each case to correlate the influence of the soil with the calcium, phosphorus, potassium and nitrogen content of the leaves.

The calcium content was found to be more dependent on the inherent capacity of each species to absorb calcium from the soil than on the calcium level of the soil itself. The more acid soils were found to limit the calcium content of the leaves somewhat. Species consistently high in calcium were Flowering Dogwood [*Cornus florida*], Black Locust

[*Robinia pseudoacacia*], Tulip Poplar [*Liriodendron tulipifera*], Basswood [*Tilia* sp.], and Hop Hornbeam [*Ostrya virginiana*], while those low in calcium were American Beech [*Fagus grandiflora*], Red Oak [*Quercus borealis*], and Hemlock [*Tsuga*].

The phosphorus content ranged from 0·08 to 0·35 per cent. and appeared to be directly correlated with the acidity of the soil, inasmuch as the more acid soils supported higher phosphorus levels in those species found on all three soil types. Flowering Dogwood, Basswood, and Tulip Poplar had high phosphorus contents, while Bitternut Hickory [*Carya cordiformis*], Hop Hornbeam, and Slippery Elm [*Ulmus fulva*], were low in phosphorus. There was no consistent correlation found between the calcium and the phosphorus levels in the leaves.

Potassium varied from 0·78 to 2·35 per cent. in content, and, like phosphorus, increased with a decrease in the pH of the soil. A positive correlation between the potassium supply in the soil and that in the leaf was observed, since the more acid soils contained the largest amounts of exchangeable potassium. Basswood, Black Locust, Slippery Elm, Striped Maple [*Acer pennsylvanicum*], Black Birch [*Betula lenta*], and Shagbark Hickory [*Carya ovata*] were high in potassium, while Blue Beech [*Carpinus caroliniana*], Red Maple [*Acer rubrum*], Pignut Hickory [*Carya glabra*], and Large-toothed Aspen [*Populus grandidentata*] appeared low.

Nitrogen, although varying from 1·11 to 3·50 per cent., was found to be limiting on all three soil types. No evident correlation between total amount of nitrate and ammonia nitrogen in the soil and the nitrogen content in the leaf was observed. Black Locust, Basswood, American Elm, American Beech and Slippery Elm were high in nitrogen. The low nitrogen species included Hemlock and Red Maple. *Author's summary.*

[203]. 21.32 : 12.25 : 12.11.11 : 31.3. NĚMEC, A. Příspěvek k seznání biochemie tisu (*Taxus baccata*). [**A contribution to knowledge of the biochemistry of Yew.**] *Lesnická Práce* 26 (1), 1947 (1–11). [Cz.f.] [Research Institute for Biochemistry and Forest Pedology, Prague.]

Literature on the occurrence in Yew of taxin and other organic constituents is reviewed, and an account is given of original ash analyses of Yew grown on igneous rocks (spilite and melaphyre) in Bohemia. Very high K and Ca contents were found throughout, but whereas K exceeded Ca in foliage and stemwood, the reverse was true of the bark. Results for foliage, wood and bark from different levels in the stem and crown are shown in tables and graphs; tabular comparisons are also made with Silver Fir, the species most resembling Yew in ash composition, though the Ca and K requirements of the latter are by far the higher. Owing to its heavy demands on these elements in the soil, Yew is a disappearing species on soils poor in lime and other nutrients, and especially on distinctly acid soils, not only in Czechoslovakia but in central Europe as a whole. Němec regards soil degradation and acidification consequent upon artificial reforestation as causes contributing to the disappearance of Yew woods.

[204]. 21.32 : 12.26–8 : 11.49.2. ZHEMCHUZHNIKOV, E. A. **On salt resistance in trees and shrubs.** *C.R. (Doklady) Acad. Sci. U.R.S.S.* 51 (1), 1946 (67–71). [E.] [A.M. Gorki Omsk Pedagogical Institute.] A.P.B.

An account of various experiments carried out at the Balkhash copper-foundry works to test the growth of certain woody species irrigated with water (from Lake Balkhash) containing a high percentage of magnesium compounds. *Morus alba*, *Robinia pseudoacacia* and *Prunus armeniaca* were the most salt-resistant species, whereas *Populus* spp., *Betula dahurica*, *Larix dahurica* and *Acer negundo* showed very poor salt resistance. The group of trees which grew best in the saline soils were generally light-loving species possessing a fair degree of drought resistance and found naturally in regions with an arid climate.

[205]. 21.32 : 12.26–8. HOLMGREN, N. T. Estudio del algunos de los factores que influyen sobre el crecimiento del álamo. [**Study of some of the factors which influence the growth of Poplar.**] *Agricultura téc., Santiago* 6 (1), 1946 (54–66). [Span.e.] A.P.B.

A direct correlation was found to exist between the timber yield of *Populus nigra* var. *italica* and the quantity of nitrate nitrogen contained in the soil. No correlation was found between timber yield and the opening

of the canopy, the depth of soil, or the amount of soluble P_2O_5, K_2O or Ca available in the soil.

21.6. *Behaviour in the Stand. Tree Classes*

See also *For. Abstr.* 9 (Nos. 193, 629, 634).

[206]. 21.63 : 22.82.1 : 24.2 : 57.0. PHILIPPIS, A. DE. Le classificazioni arboree come base della tecnica dei diradamenti. [**Tree classes as the basis for thinning.**] *Ital. for. mont.* 1 (2), 1946 (39–51). [It.]

The author urges the importance of a thorough examination of stand structure and the classification of trees by degree of dominance or suppression, as a basis for thinning pure, even-aged stands. After reviewing the principal systems in use, he propounds one of his own, which is specially adapted to the pure, even-aged stands of Fir and Beech in the Appenines. He proposes four main classes: predominants or superdominants, dominants, intermediate (divided into sub-dominants and sub-dominated) and dominated (divided into dominated and suppressed).

[207]. 21.63 : 22.83.2 : 12.25. PHILIPPIS, A. DE. Le classificazioni arboree nei boschi disetanei. [**Tree classifications in uneven-aged woods.**] *Ital. for. mont.* 2 (2), 1947 (75–84). [It.]

The author first reviews various systems of tree classification for uneven-aged stands already propounded on the Continent and in North America, and then puts forward a new system particularly suited to the mixed Fir/Spruce stands of the Italian Alps, but capable of adaptation to other uneven-aged stands. He divides the canopy into tree strata taking as the upper limit of the canopy the average height (Hm) of the mature trees. Stratum (1) includes all trees of height between Hm and $\frac{2}{3}$ Hm, Stratum (2) those of height between $\frac{2}{3}$ and $\frac{1}{3}$ Hm, and Stratum (3) those of height below $\frac{1}{3}$ Hm. The trees in Stratum (1) are subdivided into three classes of mature, overmature and immature, those of Stratum (2) into two classes, thrifty and senile, and those of Stratum (3) into three classes, seedlings, saplings and senile. These classes are capable of further subdivision.

21.8. *Phenology*

See also *For. Abstr.* 9 (Nos. 94, 110, 194, 608–9).

[208]. 21.8 : 12.26–8 : 12.14.7 : 11.14. PORTÈRES, R. Action de l'eau, après une période sèche, sur le déclenchement de la floraison chez *Coffea arabica* L. [**The action of water in initiating flowering in *Coffea arabica* after a dry period.**] *Agron. trop.* 1 (3/4), 1946 (148–58). [F.] E.M.B.

Experimental watering of 8 plots of *Coffea arabica* in French Guinea after a dry period of one month, led to the following conclusions: Drought has an inhibiting effect on floral development, irrespective of the stage of development reached by the buds. The pluvio-floral threshold which initiates flowering of *Coffea* is 3·3 mm. The time necessary for buds to become full blown after rain is constant (14 days in this experiment) regardless of the size of the bud at the time of rainfall (varying from 0·1 mm. or less to 6 mm. in this experiment) or the quantity of rain in excess of the pluvio-floral threshold. The growth of the bud is continuous or discontinuous from the date of rainfall to that of opening, according to its initial stage of development and the amount of water received. In addition to acting on existing or latent buds, it appears that rain also induces the possibility of one or more later flowerings.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.1. *High Forest Forms*

See also *For. Abstr.* 9 (Nos. 44, 512).

[209]. 22.12.1 : 12.25 : 23.1 : 56 : 57 : 76 (485). ENANDER, M. Skärmställning av tall som föryngringsåtgärd, dess utförande och ekonomi. [**Shelterwood fellings in Scots Pine as a regeneration measure; their execution and economics.**] *Svenska Skogsv-Fören. Tidskr.* 45 (1), 1947 (11–22). [Sw.]

Owing to constant competition for light, water and nutrients, natural selection in regeneration under shelterwood is severe, and such regeneration is likely to include a high proportion of 'plus variants', so that, later, part of the co-dominant stand will be genetically similar to the dominants, giving a forest relatively more suitable to respond to heavy

types of fellings. Results from the State forest survey and of the author's studies suggest that stem form is better in forests of central Sweden where regeneration under shelterwood has been common practice, than elsewhere. Examples are quoted to show that under favourable site and climatic conditions regeneration by this method gives better results than patch sowings or planting on clear-felled areas.

The method used in the mining region of central Sweden was to remove all Norway Spruce and undergrowth in charcoal-wood cuttings, then after some years to take out the inferior Scots Pine so as to leave the best trees at about 150 per ha., as evenly distributed as possible. According to the effect of the regeneration on the increment of the old wood, the latter was removed in one or two operations. Regeneration fellings can be made from about 80 years of age onwards. The author's results show that at the appropriate age for these the growing stock should be about 15–20 times the theoretical quality class expressed in cu.m. The seedbearers should be the best in quality. Until regeneration is established, biological considerations should govern the removal of the overwood; later, economic ones may be decisive.

Regeneration fellings should reduce the increment of the overwood to about $\frac{1}{2}$ that of the theoretical quality class, but the increment of the residual stand will be on larger and clearer timber than normal. Felling and extraction costs are about 30 per cent. higher than for clear fellings, cleaning costs in the regeneration about the same as for sowings, and costs of beating up about 20 per cent. of those for sowings. The value increment on seedbearers in Garpenberg Crown Park (not reckoning the higher quality of the timber produced, which alone ought fully to meet the extra felling and extraction costs) has been shown considerably to exceed the average for the site quality concerned.

Notes are appended on plots at Garpenberg treated since 1929 as two-storeyed forest in order to determine whether the value yield of the overwood could be maintained by heavy cleanings in the underwood without detriment to the latter or its future yield. The overwood was Scots Pine aged 86–108 years, and the underwood Scots Pine, Norway Spruce and Birch, aged 11–16 years. Cleanings were highly selective and were designed to transfer the whole increment of the lower storey to as few stems of as high quality as possible. Revisions in 1939 and 1943 showed improved increment for both underwood and overwood, with satisfactory value increment per cent. on the latter. Form in the overwood was practically constant for the upper $\frac{9}{10}$ of the stem, though there was some deterioration in the breast-height form factor. By 1943 some fresh regeneration of all three species had occurred. From 1943 to 1945 about 25 per cent. of the overwood was removed on two of the plots; this caused felling damage to only 8 per cent. by number of trees in the understorey. As a rule, felling damage is unimportant in young growth under 10 years old, as there are sufficient stems to replace casualties.

22.2. *Coppice Forest*

See *For. Abstr.* 9
(Nos. 106, 193–8, 548, 653).

22.6. *Changes of Silvicultural System*

[210]. 22.6 : 12.26–8 : 12.25 : 23.5 : 24.31 : 11.62.21 : 22.11. MACLEMAN, A. **The conversion of Birch scrub areas to coniferous plantations (with special reference to Longart Forest).** *Scot. For. J.* 60 (2), 1946 (88–94).

The early method of treating scrub areas in state forests was the complete elimination of Birch, either by clear felling or by girdling, but experience soon showed the undesirability of this wholesale rapid clearance, which upset the water relationship so that the surface soil became waterlogged and additional draining was necessary. This article gives an account of conversion methods used at Longart Forest in Birch scrub areas. The systematic application of the group method was initiated in 1933. Existing gaps were made use of wherever possible and were, when necessary, modified or enlarged by girdling or felling the superfluous Birch. When completed, each 'group' presented the appearance of a blank space surrounded by a ring of Birch trees. Felled trees were usually allowed to lie, after being branched, and brushwood was piled in and around the ring of standing Birch. About 90 per cent. of the area was cleared in this way, the remaining 10 per cent. being occupied by

Birch 'rings'. Clearings varied in size from $\frac{1}{8}$ to 1 acre. In 1941–42, owing to shortage of labour, even thinning was employed instead of the group system; the tallest and best-shaped Birch were left standing, 20–30 feet apart, and the others were girdled. Planting in both cases was in lines of notching, at $4\frac{1}{2}$–$5\frac{1}{2}$ ft., of various conifers, largely Norway Spruce. On the whole, the even thinning method gives more uniform results in the growth of the conifers and is also initially much cheaper (35s. per acre compared with 50s. for the group method). Furthermore, the need for thinning out the Birch rings in order to reduce shade added a further 40s. per acre to the cost of the group method. It is considered that, where the Birch scrub is of good quality there is much to be said for using the group method to establish a Birch/conifer stand, which has amenity, silvicultural and economic advantages. Where the scrub is of a poor type, the even thinning method would probably be the more advantageous. By selecting the best Birch to act as nurses for as long as required, and getting rid of the others, a forest condition would be created which should be ideal for the gradual formation of a pure coniferous wood.

If labour is available for burning the brushwood, scrub-cutting should be done not more than one year before planting; if burning is not possible, 2–4 years are necessary to allow for disintegration of the brushwood, but this runs the risk of losing the suppression of rough herbage. Spring or early summer is the best time for girdling. If a downward cut is made, penetrating about one inch into the sapwood, the Birch will die in about 3 years; if bark and cambium alone are removed, 5 years or more may elapse before individual trees die off, which may be a useful way of utilizing and regulating overhead shade for a longer period. If a market can be found for the Birch removed, either as firewood or for some other local purpose, this will, of course, substantially reduce the initial establishment costs.

23. FORMATION OF STANDS

[211]. 23 (44). MANCIOT, A. Le reboisement. [**Reafforestation.**] Guy Le Prat, Paris, 1945. pp. 136. [F.] Price 75 francs (10s. 6d.).

A practical silvicultural manual for the use of landowners, etc., including notes on the principal forest species of France.

[212]. 23 (69). KING, H. C. **Interim report on indigenous species in Mauritius.** Forest Department, Mauritius, 1946. pp. 21.

Damage by deer is a serious obstacle to the raising of indigenous species under a shelterwood of Pine, and any form of weeding or cleaning in circles or lines exposes the plants to the deer. Moreover, the rotation of Pine is not more than 40 years while that of the indigenous species is 80–100 years or more, and there is some evidence that the normal tendency of the latter to shallow rooting is accentuated by competition with the older Pine roots. *Terminalia angustifolia* in pure plantations with no shelterwood has made satisfactory growth. (pp. 4–8).

23.1. *Natural Regeneration*

See also *For. Abstr.* 9 (Nos. 17, 150, 209, 462, 526, 632).

[213]. 23.1 : 12.25 (71.1) : 22.1 : 66. POGUE, H. M. **Regeneration and growth of White Spruce after logging.** *Tech. Publ. B.C. For. Serv.* No. T29, 1946. pp. 26.

Cut-over areas of White Spruce (*Picea glauca*) in Central British Columbia were examined in 1945. Adequate re-stocking was found to be the result of a well distributed residual stand rather than any other factor or group of factors. It is recommended that all trees in the 12-inch diameter class be left, and that all trees in natural openings be left, regardless of their diameter, if their removal would increase the size of the opening or unduly increase the amount of light falling on the forest floor.

In most places Balsam reproduction and advance growth is dense compared to Spruce in the years following cutting, but after about 15 years the dominance of the Spruce is more evident and it eventually responds to release better than Balsam. No evidence was found of Spruce being suppressed by Balsam and on the other hand there is much evidence that the presence of a fair residual stand of Balsam is of great value in the development of Spruce forest. The Balsam helps to shade the ground and so slow up the development of dense undergrowth, encourages the establishment

of Spruce seedlings, and also acts as a nurse crop for the advanced Spruce.

[214]. 23.1 : 12.25 : 12.14.3 : 21.3 : 12.19. KALELA, E. K. Männyn taimien juurien suhtautumisesta emäpuun juuriin. **[Behaviour of roots of Pine seedlings towards those of the mother tree.]** *Acta forestalia fennica* 50 (17), 1942. pp. 12. [Fi.g.]

[215]. 23.13 : 12.25 : 43.11. COOMBS, W. F. **Certain aspects of Chir (*Pinus longifolia*) regeneration.** *Indian For.* 73 (1), 1947 (39–42).

The disadvantages of controlled burning in *Pinus longifolia* regeneration before the winter rains (October/December) are compared with the advantages of controlled burning during March/April. In the latter case, the grass is nearly all quite dry and recumbent so that the fire runs along the ground; the young Chir plants are more sturdy and their bases have become hard and firm; it is believed that early burning by killing or paralysing the lower branches, stimulates height growth. Provided that the seeding felling has been rightly applied, the first controlled burn can be done safely and advantageously as soon as the young seedlings are about a foot high.

23.2. *Artificial Regeneration*

[216]. 23.2 (42.1–8). BEST, F. C., and ROSS, J. M. **Group regeneration in amenity woodlands at Alice Holt Forest.** *Forestry* 20, 1947 (21–5 + plate).

[217]. 23.2 : 12.25 (44). VAISSIÈRE, J. DE. Considérations sur les peuplements de pins de la forêt domaniale de Rambouillet. **[The Pine stands of the state forest of Rambouillet.]** *Rev. Eaux For.* 85 (4), 1947 (201–22). [F.]

An account of the methods employed in establishing the stands during the 19th century (derived from the archives, which are unusually full) and suggestions for regenerating them after the devastation of the war. The value of preliminary clearing and cultivation are emphasized.

[218]. 23.2 : 12.25 (729.1) : 21.0. FORS, A. J. El pino macho, *Pinus caribaea*, en las lomas de Trinidad, Cuba. **[*Pinus caribaea* in the hills of Trinidad, Cuba.]** *Carib. For.* 8 (2), 1947 (125–34). [E.Span.f.]

Study of the Pine forests of Pinar del Rio, Cuba, has shown that of the two Pine species present, *Pinus caribaea* and *P. tropicalis*, the latter is the more abundant as it persists in degraded soils where fire and erosion are of frequent occurrence, while *P. caribaea* needs better soils. *P. tropicalis* is, however, much more slow-growing and cannot be artificially regenerated. Experiments in artificial establishment of *P. caribaea* promise well. In 1940 some 6,000 small trees were planted on steep slopes facing west, and in 1942 another 6,000 were planted on less steep slopes facing south. In both cases 2-year-old seedlings in bamboo pots were used; no previous preparation of soil was done; planting holes were made with hoes; spacing was at 2–3 m. After 6 years the first plantation has an average height of 6 m. The best specimens measure 5 m. in height and 60 cm. girth at the base. A pure plantation of 3,000 trees of *Cupressus benthami* was established in 1942 with seed from Guatemala. Growth was very rapid. Trees, spaced 2·5 × 2·5 m. have formed a dense thicket; mean height of trees is 5 m. and girth 40 cm. at base. This species grows at altitudes of 4,000–11,000 ft. in Guatemala, but grows well at a few meters above sea-level in Cuba.

[219]. 23.2 (729.5) : 07.6. WADSWORTH, F. H. **The second year in the Cambalache Experimental Forest.** *Carib. For.* 8 (1), 1947 (65–77). [E.Span.f.]

Research is being directed mainly towards the improvement of the existing forest on the limestone hills of the north coast of Puerto Rico by elimination of poor trees and planting. The following general conclusions have been reached: (1) Natural vegetation on the limestone hills should never be eliminated at the time of planting forest trees; (2) Sawtimber species should not be planted on eastern slopes and hilltops with shallow soil, where annual rainfall is less than 70 in.; (3) When planting under the shade of existing trees, spacing should be not less than 10 × 10 ft. or about 400 trees to the acre.

23.22. Preparatory Work. Auxiliary Measures

See also *For. Abstr.* 9 (No. 253).

[220]. 23.22 : 44.1 : 12.29 : 23.24.2. **Scalping and mulching increases the**

growth of hardwood seedlings planted in Iowa prairies. *Rep. Cent. St. For. Exp. Sta. 1945*, 1946 (11–13).

Two separate but correlated investigations of root competition between grasses and hardwood seedlings were undertaken in Iowa during 1941. The first was a greenhouse study of the comparative rates of soil-moisture depletion by hardwood (Locust and Ash) seedlings and grass. Grass absorbed more soil moisture than the tree seedlings during the first 6 days of the wilting period as well as during the entire period. Comparison was made also of planting on sites from which sod had been removed, with and without a mulch consisting of the reversed sod. The sites were circular and measured 0·5, 1·0, 2·0, and 4·0 ft. in diameter. Seedlings planted in the 4 ft. mulched scalps grew about 85 per cent. more than those planted in the 1 ft. mulched scalp. The combined effect of scalping and mulching resulted in greater seedling growth as the size of scalp was increased successively from one to four feet. Except on the smallest scalp, the addition of mulch increased seedling growth. Responses to mulching alone were tripled for each successive increase in diameter of scalp. Neither scalping nor mulching had a significant influence upon seedling mortality. The results of the greenhouse study emphasize the necessity for removing competing grasses before planting hardwood seedlings on sites supporting a heavy sod. The maximum response to scalping alone was obtained on the 2 ft. scalps, the maximum response to scalping and mulching on the 4 ft. scalps.

[221]. 23.22.1 : 07.7. PABLO. Traktorer för markberedning. [**Tractors for soil scarification.**] *Skogen* 34 (10), 1947 (155–6). [Sw.]

Trials have been made in Sweden of 3½-ton converted British fighting vehicles of the Bren carrier type (having Ford V-8 motors and Ford gear-boxes and rear axles—an advantage from the point of view of obtaining spares), scout jeeps (about 4-ton; with 4-wheel drive), and for comparison a Swedish-made military tractor of the Allis-Chalmers type, for pulling soil scarifiers of the type devised by Sjöström. [See *For. Abstr.* 8 (No. 2381)].

The converted carrier gave good results over fairly difficult ground; its chief troubles were bogging down in the very wet places and its low clearance (about 65 cm.). The scout jeep was inferior to the carrier in that it had a greater tendency to bog down, but on the drier and firmer sites, e.g. flat heathland, it would presumably give good service. The Allis-Chalmers type of tractor was superior to both fighting vehicles in its ability to come through heavy going, but is considerably dearer. The fighting vehicles are relatively cheap and can be got without long delay.

23.23. Sowings

[222]. 23.23 : 12.25. CRIVELLARI, D. Risultati di alcuni esperimenti sulle semine del pino domestico. [**Results of certain experiments on the seed of *Pinus pinea*.**] *Ital. for. mont.* 1 (4), 1946 (129–34). [It.]

A study was made with the purpose of determining the optimum date and depth for sowing, the percentage of seedlings from seed taken respectively from the top, centre and lower part of the cone, the effect on germination of presoaking seed, and the relative germination of cracked and intact seed. The first four experiments were in the Forest of Cecina, near Leghorn, with locally obtained seed, and the fifth on the Venetian coast with seed from the Forest of Ravenna. It was found that spring sowings, made not later than March, were the most satisfactory. In sandy soils seed should be sown at a depth of not less than 4 cm. nor more than 5–6 cm.; in heavy or compacted soils the depth should not exceed 2–3 cm. It was found that seed taken from the upper third of the cone gave 17 per cent. more germination than seed taken from the lower two-thirds. Presoaking effected no significant speeding up of germination. A large proportion of the seed collected at Ravenna was found to be cracked longitudinally. Cracked seed gave 80 per cent. germination, and intact seed only 50 per cent.

23.23.1. *Seed Procurement, Treatment, and Testing*

See also *For. Abstr.* 9
(Nos. 17, 98, 125–7, 187, 571–2).

[223]. 23.23:1 : 11.44 : 12.19. OLMSTED, N. W., and CURTIS, J. D. **Seeds of the forest floor.** *Ecology* 28 (1), 1947 (49–52). [Department of Forestry, Univ. of Maine, Orono.]

Four samples, 1 ft. square, down to the mineral soil, were taken from the forest floor of each of four softwood and three hardwood stands in northern Maine, and examined for number and species of seed. The extracted seed was pre-treated and exposed to suitable temperatures for germination tests. The greatest number of seed found was at the rate of 11,543,400 per acre, but the greatest number of viable seed was only 653,400 per acre. Seed of *Rubus* spp. was found in more stands than any other species of plant and two-thirds of the *Rubus* seeds germinated in 14 days. *Rubus* plants were absent from all stands and it is probable that the seed had been produced by plants later crowded out by shade or root competition. The presence of these germinable seeds may explain why so many plants of *Rubus* establish themselves quickly on areas drastically changed by cutting or burning.

[224]. 23.23.11 : 12.25 (77.6). Roe, E. I. **Extended periods of seedfall of White Spruce and Balsam Fir.** *Tech. Notes Lake St. For. Exp. Sta.* No. 261, 1946. p. 1.

Data on the rate of opening of cones and shedding of seeds.

[225]. 23.23.11 : 12.25 : 21.8. Fritz, E. **Seed production of a Sugar Pine tree.** *J. For.* 45 (3), 1947 (210–3).

Records made of the annual cone production of a Sugar Pine in California from 1924 to 1945, show that a region-wide crop abundance or failure is not always reflected, and may be contradicted in an individual tree.

[226]. 23.23.12 : 07.7. Steiggerät. [**Climbing instrument.**] *Merkblatt der Beratungsstelle für Waldsamenbeschaffung. (Mémorandum de l'Office de renseignements et conseils pour l'obtention de graines forestières.)* No. 8, 1947. In *Suppl.* to *Schweiz. Z. Forstw.* 98 (1–3), 1947. pp. 9–12. [G.F.]

A fuller description of the 'Baumvelo' climbing instrument [previously noted in *For. Abstr.* 8 (No. 2384)], with constructional diagrams and notes on method of use and maintenance.

[227]. 23.23.12 : 07.7 : 32.25.1 : 82. Zehnder, J. Neuerungen am Sicherungsgurt für das Baumsteigen. [**New features on the safety belt for tree climbing.**] *Schweiz. Z. Forstw.* 98 (3), 1947 (119–21). [G.]

The safety belt most commonly used in Switzerland has been improved by the provision of an auxiliary cable and of a stout, non-slip lever clasp (figured) for securing the main cable, which passes round the tree, at any desired length.

[228]. 23.23.13 : 12.25. Kangas, E. Karistuslämmön vaikutuksesta männyn siemenen karisemiseen ja itämiseen. [**The effect of extraction temperature on the extraction and germination of Pine seed.**] *Acta forestalia fennica* 50 (14), 1942. pp. 42. [Fi.g.]

[229]. 23.23.15 : 12.25 : 12.26–8. Way, R. D., and Maki, T. E. **Effects of pre-storage treatment of hardwood and Pine seedlings with α-naphthaleneacetic acid.** *Bot. Gaz.* 108 (2), 1946 (219–32). O.B.D.

Experiments involving methods of application and various concentrations of naphthaleneacetic acid, applied as pre-storage treatments to prolong dormancy and lessen deterioration of forest planting stock in unrefrigerated storage, were carried out on two hardwood (Black Locust and Eastern Red Oak) and two Pine (Loblolly Pine and Red Pine) species.

Response to the treatments varied widely by species from significant benefits to distinct injury. The Pines were much more vulnerable to injury than the hardwoods. The main effects evident after the removal of the stock from storage and after planting-out in the field are enumerated. Even with the most effective treatments, dormancy was not adequately maintained for longer than one or two months. When storage for a longer period is necessary, it seems unlikely that naphthaleneacetic acid treatments can satisfactorily replace refrigeration. *From authors' summary.*

[230]. 23.23.15 : 12.25. Holten, N. E. Planteskoleforsøg II. [**Nursery experiments. II. [Acid pre-treatment of conifer seed].**] *Dansk Skovforen. Tidsskr.* 32 (2), 1947 (74–9). [Dan.]

In continuation of the experiments noted in *For. Abstr.* 8 (No. 1038) a further trial was made with seed sown dry or pre-soaked for 24 hours in either water or dilute HCl (brought to pH 4·2–6·0, using methyl red and bromthymol blue as indicators). Increases in the number of plants obtained as a result of treatment (expressed in per cent. of results for

seed sown dry) were: *Picea abies*: water treatment 17; acid treatment 115. *Larix decidua*: about 20 for water and 24 for acid treatment, but both treatments markedly improved the rate of germination. *Pseudotsuga taxifolia*: water treatment, no considerable effect; acid treatment, over 60. *Pinus sylvestris*: water 25, acid treatment over 80.

Acid treatment has thus given substantial improvement of the plant per cent. with Douglas Fir, Scots Pine, and especially Norway Spruce. The last-named has shown this improvement in two different years, one wet and the other dry, the results suggesting that the treatment is particularly important when a dry period follows after sowing, and hence is presumably to be recommended for seed sown in light and dry soils. The method is cheap and easy to use.

[231]. 23.23.15 : 12.26–8 (729.5). PUERTO RICO. **Seed studies.** *Rep. U.S. trop. For. Exp. Sta. 1946*, 1947 (20).

Studies of germination and storage have been made on seed of 155 native and exotic species. Concentrated sulphuric acid scarification of *Sciacassia siamea* for 10 minutes, reduced the germination period from 60 to 10 days. Viability of seed of *Swietenia macrophylla* and *Cedrela mexicana* can be increased from 3 to 9 months by storage at 40° F., and that of *Montezuma speciosissima* from 2 weeks to 2 months by storage at 40° F. when dried to 62 per cent. of natural moisture content. Seeds of *Manilkara nitida* and *Lucuma multiflora* remain viable only one month at room temperature. Low germination in *Bucida buceras* is due to incomplete seed formation and insect attack. Seeds of *Guaiacum officinale* are not mature until they turn orange, and cold storage is detrimental to their viability.

[232]. 23.23.15 : 12.26–8 : 23.23.19. JOHNSON, L. P. V. **Effect of humidity on the longevity of *Populus* and *Ulmus* seeds in storage.** *Canad. J. Res.* 24C (6), 1946 (298–302). D.S.I.R.

Storage of *Populus tremuloides* and *P. grandidentata* seeds at room temperature showed the optimum to be 20 per cent. relative humidity for both species. At this level, seed viability was retained by *P. grandidentata* for 555 days and by *P. tremuloides* for 455 days, as compared to approximately 28 days for both controls (open air).

Similar storage of seeds of four *Ulmus* species showed tolerance of a wide humidity range by all species, the optimum storage condition being within a range of approximately 20 to 50 per cent. relative humidity.

Germinability in all four *Ulmus* species was greatly increased when seeds were tested in a lighted germinator. *Author's summary.*

[233]. 23.23.19 : 23.26. GOUFFON, C. L. **Plantable trees per pound of seed.** *J. For.* 45 (3), 1947 (203–4).

Yield of plantable seedlings per pound of seed has been recorded annually for the two nurseries operated by the Tennessee Valley Authority. A summary of 12 years' results based on the production of 160 million seedlings and the use of 85,000 lb. of seed, is given in tabular form for 28 species.

23.23.3. *Methods of Sowing*

[234]. 23.23.3 : 12.25 : 45.12 : 12.25 : 13.2. HELMERS, A. E. **Results of direct seeding Ponderosa Pine.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 46, 1946. pp. 5.

For earlier reports on this experiment, see *For. Abstr.* 1 (257), 2 (132), 5 (110). The importance of protecting Ponderosa Pine seed spots from rodents is further demonstrated. Protection was accomplished through the use of conical wire screens placed over the seed spots. Higher initial stocking resulted from autumn than from spring sowing. Cultivation had no significant effect on germination and early stocking. Growth of seedlings on seed spots has not equalled that of nursery-grown trees.

23.24. Formation of Stands by Planting

See also *For. Abstr.* 9 (No. 220).

23.24.1. *Planting Material*

See also *For. Abstr.* 9 (Nos. 229, 245).

[235]. 23.24.1 (494) : 23.23.1 : 23.26. FISCHER, F. Resultat einer Umfrage über den Pflanzenbedarf während der Nachkriegszeit. **[Result of an enquiry on planting-stock requirements during the post-war period**

[in Switzerland].] *Schweiz. Z. Forstw.* 98 (2), 1947 (67–72). [G.f.]

The findings are that: (i) The required annual production of planting stock during the years of reconstruction will certainly exceed 23,844,000; and if mountain afforestation is intensified and the rehabilitation of lowland forests not neglected, 30 million plants annually will be barely enough. (ii) Present production of plants is 3,179,000 short of requirements. For the country as a whole it would be easy to make up double this deficit, but for certain species and regions real difficulties will arise. (iii) Present nursery space is inadequate, and individual nurseries are often too small and inadequately organized and equipped.

Measures suggested are: (i) Reconnaissance, registration and observation of, and seed collection from, suitable stands for seed production; possibly also the establishment of seed plantations in areas with a large seed requirement. (ii) Reasonable centralization of nurseries (the area of which should not be less than 20–30 acres) and extension of their total area by about ⅓, to 250 ha. (iii) Rational nursery management in the interests of seed economy and reduction of costs and time necessary to achieve their aim, which is to assure supplies, in each region, of plants of suitable race, guaranteed origin and quality.

[236]. 23.24.1 : 12.26–8 : 23.26 (492). HOUTZAGERS, G. Het kweeken van populierenheesters. [**The raising of Poplar planting stock.**] *Ned. Boschb.-Tijdschr.* 14 (3), 1941 (114–7). [Du.]

[Cf. *For. Abstr.* 9 (No. 186).]

[237]. 23.24.1 : 12.26–8 : 56.01 : 56.02. BENASSI, L. Accrescimento in altezza delle piante di pioppo canadese e una norma colturale. [**Height increment of 'Canadian' Poplar plants and a planting standard.**] *Ital. for. mont.* 1 (5), 1946 (222–3). [It.]

A study was made of a 20-year-old plantation of 'Canadian' Poplar, planted in a single row along the bank of the River Arno. The original planting stock had been 2-year-old rooted cuttings. The trees were divided into three diameter classes, (1) those above 32 cm., (2) 22–32 cm., and (3) below 22 cm. Four average specimens of each of classes (1) and (2) and six of class (3) were then felled and the height attained at various ages was determined by means of stem analyses. At two years old the plants at class (1) had averaged 4·10 m. in height, class (2) 2 m., and class (3) 1·70 m. At 4 years old the corresponding figures were 8·40 m., and 4.40 m., and 3.00 m. It is thus clear that, even in the nursery, it is possible to distinguish those plants which are endowed with the most rapid growth, by an examination of their height development and, by choosing the largest and rejecting the smallest, to exercise an effective selection.

[238]. 23.24.1 : 12.26–8. **Effect of diameter of Teak stump on survival and height growth.** *Indian For.* 73 (3), 1947 (120–1). [Hoshangabad Division Central Provinces, Bori Special Teak Working Circle.]

Cf. *For. Abstr.* 6 (23) and 7 (No. 1754).

Results confirm the conclusions arrived at earlier that it is not worth while to use small stumps of 0·3–0·4 in. diameter. Survival percentage was comparatively low, and even after three growing seasons height differences were significant.

23.26. Plant Rearing. Nursery Practice

See also *For. Abstr.* 9 (Nos. 229–33, 235–7, 535).

[239]. 23.26 : 12.26–8 (729.5) : 44.1. PUERTO RICO. [**Nursery studies.**] *Rep. U.S. trop. For. Exp. Sta. 1946*, 1947 (19).

Preliminary studies of propagation of 102 native and exotic species have been made in Puerto Rico, in order to develop methods for the economical production of planting stock with capacity for high survival in the field. Optimum spacing for *Eucalyptus globulus* was found to be 6 × 6 in.; for *Casuarina equisetifolia*, 1 × 6 in.; and for most other species, 3 × 6 in. The root system of *C. equisetifolia* is materially improved by transplanting, which should be done when seedlings are 8–10 in. high. *Dacryodes excelsa* is difficult to propagate at sea level, but does well at 2,500 ft. Seeds of *Manilkara nitida* should be sown in moist leaves, as they are not sufficiently strong to push up through soil. Discontinuation of watering of *Sciacassia siamea* stock one month before lifting caused marked hardening of stock and higher field survival. *Crotalaria striata* is a fairly satisfactory nursery cover crop, providing a good cover and abundance of

organic matter in a short time. A solution of 0·075 per cent. 2,4-D effectively killed weeds other than grass in nursery beds, without damaging *E. robusta*, but solutions of even half that strength were fatal to *C. equisetifolia*.

[240]. 23.26 : 44.1. DEASY, J. J. **Notes on the disposal of weeds in the forest nursery.** *Irish For.* 3 (2), 1946 (93–5).

The writer considers that disposal of weeds in the manufacture of compost is unsatisfactory, since it often leads to the repropagation of the weeds if imperfectly matured compost is applied to the nurseries. He recommends burning and describes the construction and operation of simple brick kilns for the purpose.

23.3. *Afforestation*

See also *For. Abstr.* 9 (Nos. 82–4, 184, 193–7, 200, 644, 686, 690).

[241]. 23.3 (47.1) : 47 : 21.0 : 12.25. KANGAS, E. Tuloksia Pohjankankaan ja Hämeenkankaan metsänviljelyksistä. [**Results of sowings and plantings on the Pohjankangas and Hämeenkangas heaths.**] *Acta forestalia fennica* 49 (4), (1940) 1942. pp. 64. [Fi.g.]

[242]. 23.3 (492) : 23.27. BOODT, P. De bebossching en de beplantingen in den Wieringermeerpolder. [**Afforestation and tree planting in the Wieringermeer Polder.**] *Ned. Boschb.-Tijdschr.* 15 (11; 12), 1942 (492–523; 579–609); 16 (1), 1943 (26–51). [Du.]

This paper contains: (i) A brief general account of the polder (which was dry land by the summer of 1930) and its history, including a description of trial plantings of trees in 1931–32. (ii) A detailed report of the afforestation at Robbenoord of about 400 ha. of mainly sandy ground. This was first sown to a cover crop of rye or grass mixtures to hold the soil until its salt content was low enough for tree growth. Green-manure crops such as yellow lupin with serradella and hop trefoil were also tried, with varying success. No tree planting was done until analysis showed the salt content of the 5-to-20-cm. horizon to be less than 1 gram per litre of soil moisture. Planting operations proper began in 1934. The main obstacles to establishment were weeds and grass, for which the best method of control was ploughing before planting and repeated hand hoeing in the first and often also in the second year after planting. Species that did well from the start in trial plantings were Willows and Poplars, Hawthorn, Sea Buckthorn, Common Alder, *Elaeagnus angustifolia*, Wych Elm and *Prunus serotina*. Later, European Ash, Grey Alder, Pedunculate Oak, Sycamore Maple, Birch, and Austrian and Corsican Pines showed good growth. Deciduous species have been most used, as they grew better in trials than the conifers and were also desired for aesthetic reasons. Apart from Common Alder, used in all plantings as an auxiliary species, the trees most used have been Sycamore Maple, Oak, Ash and Sitka Spruce, with some Poplar, Birch, Austrian and Corsican Pines, and a number of other tree and shrub species. Growth has been good on the whole, and in some instances remarkably good. Reasons for the choice of species are discussed in detail and typical spacings for the mixtures are indicated. A salicetum was also established to determine what Willows might be best for local use, and several small areas were stocked with berry-bearing bushes in the belief that birds will distribute their seeds in the surrounding plantations. In the latter the auxiliary stands of Alder are removed in gradual cleanings, removal generally being complete by the fifth year, and the resulting coppice growth aids in soil protection. In some cases, underplanting has been done with shadebearers such as Beech, Hornbeam, Chestnut and Hazel. (iii) A chapter each is devoted to: (*a*) Plantations along canals, drains, dikes and on odd patches of land difficult to use for agriculture; (*b*) Tree planting in farmyards, in and near villages, in cemeteries, etc.; (*c*) Nurseries. (iv) An appendix lists all the species tried, with remarks on growth, purpose for which grown, and the like.

[243]. 23.3 (492) : 21.0 : 96.5 : 60.2. REINDERS, E. Notities over afbraak en opbouw der Zeeuwsche beplantingen. [**Notes on the destruction and reconstitution of plantations in Zeeland.**] *Ned. Boschb.-Tijdschr.* 18 (3), 1946 (51–9). [Du.]

A short review of the war-time damage to plantations, especially by inundation, with suggestions on the planning of replanting operations and choice of species.

[244]. 23.3 (54) : 21.0. GRIFFITH, A. L. **The necessity for afforestation in the dry**

areas [in India]. *Indian For.* 73 (1), 1947 (1–4). [Forest Research Institute, Dehra Dun.]

[245]. 23.3. (54.2) : 11.62.11 : 12.29. SINHA, J. N. **Reforestation of flat denuded land in Dhalbhum Forest Division.** *Indian For.* 73 (1), 1947 (5–10 + plate).

Dhalbhum has a mean temperature of 53—105° F. and an annual rainfall of about 45 in. *Bambusa nutans* is successful if planted well in advance of the break of the monsoon. Better results were obtained when the size of the stem attached to the planting rhizome was increased from the usual 2–3 ft. to 6–8 ft. Instead of fences, trenches with the bundh planted with *Dalbergia sissoo* and *Artocarpus integrifolius* can be made effectively at about Rs. 376 per mile (pre-war wage rate).

1,206 acres of denuded land are being planted with trees, Bamboos, and *Sabai*, at Rs. 24 per acre, or, including fencing, Rs. 35 per acre.

Stump planting has given good results, but costs are comparatively high. The method adopted consists of twice ploughing and then broadcast sowing with *Pterocarpus marsupium*, *Gmelina arborea* and other species mixed with Boga [*Tephrosia candida*], which acts as a nurse crop.

[246]. 23.3 (57.6) : 23.27. SHIPCHINSKI, N. B. Teoreticheskie i prakticheskie osnovy zelenogo stroitel'stva v pustynyakh i polupustynyakh Kazakhstana. [**Theoretical and practical bases of afforestation and arboriculture in the deserts and and semi-deserts of Kazakhstan.**] In *Sbornik Nauchnykh Rabot . . . (1941–1943)*. Botanicheski Institut im. V.L. Komarova, Leningrad. 1946. pp. 433–7. [Russ.] [Abstract of thesis.]

Seven hundred tree and shrub species have so far been cultivated with success in this region, and it is believed that, in view of the varied climate of Central Asia, a far wider range of trees and shrubs (up to 1,200 or more species) could be introduced. On the basis of climatic and soil conditions, together with the experimental results of plant introduction, the territory is divided for plantation purposes into 5 main latitudinal zones (map), viz. Western Siberian; North Kazakhstan; Central Kazakhstan; South Kazakhstan; and South-Central Asia.

Recent planting work in towns of the desert and semi-desert zone of Kazakhstan has demonstrated the possibility of cultivating tree and shrub species, has given indications on choice of species, and proved that salinity of the soil and shortage of fresh water are not insuperable obstacles, provided that technique and choice of species are correct. Cultural technique is of special importance, and efforts should be made for further improvement in this direction. In the opinion of the author the principles used in this work are applicable to other arid areas in Asia, e.g. the desert and semi-desert zones of Persia, Afghanistan, western and central China, and in some measure to other arid regions of the earth.

[247]. 23.3 (77.1) : 11.62. **The effects of levelling on spoil-bank material.** *Rep. Cent. St. For. Exp. Sta. 1945*, 1946 (10–11).

The use of surface-mined land for cropping raises the question whether spoil mounds should first be levelled. One of the best measures of physical soil change is infiltration rate and accordingly a study was made near Magnolia, Ohio, of infiltration in levelled spoils, unlevelled spoils, and adjacent old field. Statistical analysis of the results showed significant differences between the three sites. Only 0·6 in. of the total of 5 in. of water striking the surface of the levelled banks percolated into the soil when infiltration became constant. The remaining 4·4 in. ran off the soil surface. Infiltration on the undisturbed spoils amounted to 4·0 in., only 1.0 in. running off. Infiltration and run-off on the old field was intermediate, 3·4 and 1·6 in. respectively. Levelled soil, in addition to becoming poorly drained and aerated by natural soil-forming processes, is usually compacted by heavy levelling machinery.

[248]. 23.3 (77.2). **1945 spoil bank plantings.** *Rep. Cent. St. For. Exp. Sta. 1945*, 1946 (9–10).

In the spring of 1945, about 50 acres of 3-year-old spoil banks in south-western Indiana were planted with 7 species of Pine and 6 species of hardwoods in both pure and mixed stands. The material of the banks varied from highly acid to highly calcareous and from extremely loose to extremely tight. At the end of the first growing season, survival counts were taken and probable cause of death was assigned. The principal causes of mortality were burying due to sliding soil, exposure of roots due to erosion or failure to plant deep

enough, excessive acidity of soil, high lime content (more deleterious to Pines than to hardwoods), compacted soil (more adverse to hardwoods than to Pines), and very loose soil.

[249]. 23.3 (77.4 : 77.5 : 77.6). RUDOLF, P. O. **The reforestation job in the Lake States—a new estimate.** *Sta. Pap. Lake States For. Exp. Sta.* No. 4, 1946. pp. 9.

Recent estimates are that about 12½ million acres in the Lake States now need reforestation. This land is classed as deforested areas, off-site Aspen areas, and understocked seedling, sapling and polestands. Suggestions are made of suitable species for planting according to each cover type.

23.5. *Underplanting. Shelterwoods. Nurses*

See also *For. Abstr.* 9 (Nos. 71, 210, 245, 537, 644).

[250]. 23.51 : 12.25 : 12.26–8 : 43.11 : 45.3. JAGERSCHMIDT, J. Le sous-bois dans la forêt landaise. [**Undergrowth in the forests of the Landes.**] *Action for. pisc.* No. 119, 1947 (1–2). [F.]

A mixture of American Oak [*Quercus borealis* var. *maxima*] sown at the same time as *Pinus pinaster*, or regenerating naturally from seed trees, has been found to be most beneficial to Pine stands in the landes region of France. It drives out the original undergrowth of heath and gorse, hastens the formation of humus, lessens the fire hazard, accelerates the growth of the Pine, and increases its resistance to bark-beetle attack. Details are given of two stands with such an undergrowth. It is recommended that the Oak should be managed as coppice.

[251]. 23.52 : 12.26–8 : 27. AZY, B. D'. Boisement et enrichissement de la forêt par le peuplier. [**Afforestation and the enrichment of the forest by the use of Poplars.**] *Action for. pisc.* No. 116, 1947 (1). [F.]

A brief account of successful experiments in the use of Poplar as a nurse species. In one instance Poplars were planted on damp ground on the edge of the forest, where the only vegetation was reeds. This was then fenced against grazing cattle. At the end of 20 years the Poplars were profitably harvested, leaving a vigorous natural regeneration of Oak and other species which had come in under their shelter. In another instance a forest, devastated by shell-fire in the 1914–18 war, was planted with Poplars, under which there is now a well stocked understorey of saplings of Oak, Beech, Ash and Lime. The Poplars will be harvested at 50 years of age.

23.6. *Fencing. Hedges. Care of Regeneration in the Initial Stage of Establishment*

[252]. 23.6. HOWES, F. N. **Fence and barrier plants in warm climates.** *Kew Bull.* No. 2, 1946 (51–87).

A short discussion of the advantages of live hedges over wire fences and the desirable characteristics of hedge plants, followed by notes on more than 100 thorny species.

[253]. 23.6 : 12.26–8 : 23.22.1. UNITED STATES. [**Frequent cultivation stimulates young Tung trees.**] *Rep. U.S. Bur. Pl. Ind.* 1946 (25).

One-year experiments in Florida and Georgia have emphasized that, unless young Tung trees are cultivated frequently during the dry months of early spring, active growth is checked and not resumed when the summer rains begin. The ordinary practice of disking the orchard three or four times and hoeing round the young trees once or twice is not sufficient. Stirring the soil close to the trees seven extra times produced well branched one-year trees 5–6 ft. high, whereas those under ordinary culture were unsatisfactory unbranched whips about 3 ft. high. The greatly increased growth fully justifies the cost of frequent cultivation.

24. TENDING OF STANDS AND TREES

See also *For. Abstr.* 9 (No. 606).

24.1. *Cleanings*

[254]. 24.1 : 12.26–8 : 23.1. KURTH, A. Untersuchungen über Aufbau und Qualität von Buchendickungen. [**Studies on the structure and quality of Beech thickets.**] *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (2), 1946 (581–658). [G.f.]

This study of Beech at the thicket stage, in various Swiss localities belonging to well defined ecological types, has shown that the

influence of site on the social and qualitative constitution of the young stands is slight, or even insignificant, in comparison with that of the immediate environment. Quality depends especially and to a very great extent on overhead cover, a moderate degree of cover having the most favourable effect. Other factors, however, are important, e.g. the frequency of unilateral curvature in the taller stems increases, on slopes, with increasing gradient. The small deviations of the stem at the junctions with branches, disappear later and are not an indication of inferior future quality. It also appears improbable that the presence of a double terminal bud indicates any strong tendency to fork at a later stage. Frost definitely lowers quality, and only a properly manipulated overwood can prevent frost damage. The 'social layers' distinguished by Schädelin [cf. *For. Abstr.* 7 (No. 1780)] were readily recognizable in the populations studied, and there would be no difficulty in applying his proposal to limit cleanings to the upper layer. Schädelin's rule that only obviously inferior saplings should be eliminated is also amply justified in view of the fact that hereditary quality is obscured by environmental effects at this stage. The lateness in appearance of hereditary quality also emphasizes the importance of seed origin, as an unfortunate choice of provenance will not be discovered until the stands are comparatively advanced in age. On the other hand, the quality of stands of unknown provenance is equally unpredictable in the thicket stage. In the tending of Beech, regulation of the overwood and cleaning operations must go hand in hand, a condition which can be satisfied by the use of either refined group and irregular shelterwood methods or the selection system proper.

24.2. *Thinnings*

See also *For. Abstr.* 9 (Nos. 80, 206, 629).

[255]. 24.25 : 12.26–8 (71). BICKERSTAFF, A. **The effect of thinning upon the growth and yield of Aspen stands (for ten-year period after treatment). Project P-19.** *Silvic. Res. Note Dom. For. Serv.* No. 80, 1946. pp. 25 + tbls. + charts.

Four Aspen stands of varying age, site, and density at the Petawawa Forest Experiment Station were heavily thinned in 1934–36. A remeasurement made ten years after treatment indicated that, although the diameter and volume growth of individual trees was stimulated by the thinning, the increment and yield per acre of the thinned plots was about the same as that of the untreated controls. The thinned plots suffered considerable damage from sun-scald and other injuries. Aspen on average sites will not stagnate from lack of artificial thinning since a very rapid natural thinning takes place in them.

There appears to be a possibility that thinning may be silviculturally and economically practicable in young (20 to 30 years) stands occurring on the best sites, which contain sufficient merchantable material to permit a profitable thinning to be made and still leave at least 400 good-quality dominant trees per acre. Failing such conditions, thinning in Aspen stands is not recommended. *From author's summary.*

24.3. *Opening of the Canopy. Release and Improvement Fellings (including Poisoning and Girdling)*

See also *For. Abstr.* 9 (Nos. 210, 339, 536, 575).

[256]. 24.3 : 12.26–8 : 32.24 : 22.22. STOECKELER, J. H. **When is plantation release most effective?** *J. For.* 45 (4), 1947 (265–71).

This test of release cutting in the Lake States showed a marked advantage in cutting Aspen suckers and sprouts in late June, just after the leaves had attained full growth. Cuttings made in winter or early spring, when the trees were dormant, were much less efficient. June cutting resulted in a reduction of 30–77 per cent. of the number of sprouts some 5 or 6 years later, while on plots cut in December, April, or August, the stocking was as high as, or higher than, originally. The new sprouts on plots cut in June or August were also much smaller than those on plots cut in April or December.

The marked reduction in resprouting in the June cuttings is attributed to the fact that reserves of plant food are at a low point shortly after the period of maximum leaf growth. Release costs could be greatly reduced merely by concentrating such work in conifer plantations at the time when it is most effective. On the other hand, if merchantable Aspen is clear-cut and a second crop is desired from the sprouts and suckers, cutting in the dormant

season will probably provide a new stand of maximum density and vigour. [Cf. *For. Abstr.* 8 (No. 2372).]

[257]. 24.3 : 22.83.2 : 76. SMITH, LL. F. **Early results of a liberation cutting in a Pine-hardwood stand in Northern Louisiana.** *J. For.* 45 (4), 1947 (278–82).

In 1933 a liberation cutting on a tract of second-growth Pine and hardwoods felled 51 hardwoods and girdled 22 per acre. An examination 7 years later showed that the treated stand averaged 320 Pines per acre not overtopped, compared with 126 on the control area. Most of the treated hardwoods had sprouted and the tallest sprouts had averaged about 2 ft. annually in height growth. However, healthy Loblolly and Shortleaf Pine seedlings which were 2 ft. or more high at the time of liberation, grew faster than this, hence liberation cutting will release such Pines permanently. Estimated values and volumes show that the benefits should outweigh the expenses of release cuttings by $3.09 per acre after 20 years and will increase rapidly thereafter.

24.4. *Shelterbelts. Windbreaks*

[258]. 24.4 : 11.12. NÄGELI, W. Weitere Untersuchungen über die Windverhältnisse im Bereich von Windschutzstreifen. [**Further studies on wind conditions in the vicinity of windbreaks.**] *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (2), 1946 (659–737). [G.g.f.]

The main results of the studies described [in extension of those noted in *For. Abstr.* 6 (92)] are:—

(i) *Measurements at 1·4 m. above ground level* ['units' = unit ground distances equal to the height of the windbreak; wind velocities as percentages of those in the open]. The depth of the protected zone is determined almost entirely by the height of the windbreak, though the nature of the wind has probably some influence, as the distance protected appears to decrease with increasing turbulence. To the windward, the average distance at which protection began was 9 units (never more than 10 or less than 5); to the leeward, protection extended for an average of 30 units (seldom more than 35, never more than 40 or less than 20). The mean curve for wind velocities at varying distances from a windbreak shows velocities to the windward of 90 at 3 units, 80 at one unit and 60 at the entry into the windbreak; to the leeward, the margin velocity is 43, reaches a minimum of 33 at 2 units, rises to 50 at 6 units and to 85 at 15 units, after which the curve flattens markedly, its further course appearing to depend almost entirely on the height of the windbreak. The curves for different types of windbreak, however, show considerable variation from the mean. Curves are also presented for windbreaks grouped by ocular estimation into four permeability classes. Though rough, this grouping clearly demonstrates the main effects of variation in density. To the windward, varying permeability has little effect, but considerable differences become evident during the passage through the windbreak and are greatest at the leeward margin, where velocities were 14 for very dense, 26 for dense, 34 for medium-permeable and 37 for very open windbreaks. Except with very open windbreaks, the greater the permeability, the farther from the leeward margin does the minimum velocity occur. The lower the minimum velocity, the more rapidly does the wind regain velocity, so that at 3 units to leeward the velocity is greater for very dense than for more permeable belts, belts of medium permeability having the smoothest wind curves and showing the best average reduction of wind velocity for the protected zone as a whole. Compared with permeability, mere width of a shelterbelt is of very minor importance, at least for the range of widths admissible in practice for this purpose.

(ii) *Special studies.* (*a*) Wind velocity measurements at heights between 0·2 and 5·0 m. revealed that the normal height of 1·4 m. is above that of the greatest variations. In addition, the effects of differing resistance of different types of ground cover are much reduced at 1·4 m. Both on the windward and the lee, the protective effect of a windbreak shows only a gradual decrease vertically and reaches, on the lee, a height considerably above that of the windbreak itself. (*b*) In the range of wind velocities from 2 to 7 m. per sec., relative velocities in the protected zone varied little with differing absolute velocities in the open, i.e. the protective effect of a windbreak is, within wide limits, largely independent of absolute wind velocity. (*c*) In the case of a gap of about 12 m. in a hedge windbreak, wind velocity was increased in the gap, but

the effect did not persist far to the lee and had no considerable lateral spread. (*d*) The results are given of attempts to confirm the deflection of winds by windbreaks as observed by Woelfle. A more important result in this connexion was the discovery of a strong turbulence zone on the lee of a dense windbreak, the effect being strongest in the region of the abrupt increase in wind velocity after a pronounced minimum. In the instance studied it is known that cereals are often 'laid' by wind by this zone.

(iii) *Practical applications.* In planning shelterbelts and calculating the depth of the protected zones it is important to make due allowance for the height which the species used may be expected to attain under local conditions. Medium permeability and as great homogeneity as possible (especially in vertical structure) are desirable. Choice of species and mixtures will be governed largely by local conditions, but a good mixture of hardwoods is preferable to pure Spruce, which is excessively dense in youth and becomes gappy in age and difficult to regenerate. The greater openness of hardwood belts in winter is an advantage from the point of view of even snow distribution. Conifers, however, may well be used in moderate mixture with hardwoods. Breadth of windbreak is important chiefly as a means of maintaining good vertical structure: 10–15 m. should suffice for high windbreaks, 5—10 m. for lower ones, and 3–5 m. for hedges. It is seldom that windbreaks can be planned systematically for whole areas, but as much advantage as possible must be taken of local features, including existing plantations.

24.5. *Pruning*

See also *For. Abstr.* 9 (No. 548).

[259]. 24.51 (410). DALLIMORE, W. **The pruning of trees and shrubs: being a description of the methods practised in the Royal Botanic Gardens, Kew.** Dulau, Oxford. 2nd ed., 1945. pp. 99 + plates. Price 7s. 6d.

[260]. 24.51 : 12.25 : 44.3. BAUER, B. Följden av grankvistning. [**Consequences of pruning Norway Spruce.**] *Skogsägaren* 21 (3), 1945 (52–3). [Sw.]

A case in which stem rot occurred in almost every other tree of a 50-to-55 year-old stand of *Picea abies* is ascribed to and used as a warning against the pruning of this species.

[261]. 24.51 : 12.25 : 12.26–8. Angående kvistning. [**A note on pruning.**] *Skogsägaren* 21 (4), 1945 (66). [Sw.]

Agreement is expressed with Bauer's warning against the pruning (at least so far as live branches are concerned) of Norway Spruce [see preceding abstract], but it is pointed out that live pruning can be recommended for Oak [*Quercus robur* s.l.] and Scots Pine [*Pinus sylvestris*]. Pruning should be done before the buds break. With Oak, it is important not to remove too much of the foliage at once, but the author's experience with Scots Pine in various parts of Sweden indicates that this species can be pruned without risk, provided that the number of whorls left in the crown is not less than the height of the tree in metres. Pine branches should be pruned flush with the stem: in Oak a short stub should be left —about as long as the diameter of the branch— and the cut should be at right angles to the axis of the branch.

[262]. 24.51 : 12.25 : 46. HELMERS, A. E. **Pruning wound healing on Western White and Ponderosa Pine.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 45, 1946. pp. 6.

Pruning which removed the branch collar resulted in considerably faster wound healing than pruning which left the branch base intact, although it made a larger wound. On dead branches, close pruning resulted in a 16-per-cent. greater average area of healing and on live branches 8 per cent. Wounds from small branches healed faster than those from large branches, particularly in the denser stands where diameter growth was slow. Wounds resulting from the removal of live branches healed faster than wounds from dead branches. Healing was more rapid on the fast-growing trees of open stands of White Pine, despite the larger size of the wounds, than on the slow growing trees of the dense stands. No appreciable differences were evident in the extent of wound healing between autumn and spring pruning. These experiments indicate that the optimum conditions for rapid wound healing result from close pruning of small live branches on rapidly growing trees.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

[263]. 3 (73) : 07.2. ARNESON, G. N. **Some observations on forest products research.** *J. For.* 45 (3), 1947 (193–7).

The writer considers that there is a tendency of American forest products research laboratories to overpublicize results, leading to an erroneous estimation of the value of such research, which actually consists largely in long-term unspectacular research into fundamental problems. Many of the most loudly proclaimed of recent results, e.g. compreg, heat-stabilized wood, urea-plasticized wood, lignin plastics, etc., are still only practicable on a laboratory scale. Discoveries such as those of fibre saturation and moisture equilibrium of wood, the determination of properties of different species, etc., are in reality much more imporant.

[264]. 3 (94) : 07.2. COOPER, K. L. **Timber research.** *Aust. Timb. J.* 12 (11), 1946 (630–41, 668).

Extract from a paper presented at the Adelaide meeting of the Australian and New Zealand Association for the Advancement of Science, giving an outline of the problems of timber research and some account of the principal lines of research at present in hand at the Division of Forest Products, C.S.I.R.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31.0. *General Information on Woods*

See also *For. Abstr.* 9 (Nos. 186–90, 449).

[265]. 31.0 (51) : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of some important woods in western Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 5, [1943?]. pp. 22 — charts. [Chin.]

[266]. 31.0 (67.6) : 07.5. **List of timbers in Forest Department collection at Nairobi.** *Bull. Kenya For. Dep.* No. 37, 1947. pp.6.

[267]. 31.0 (944) : 33.12. **Substitutes for Oregon.** *Tech. Notes For. Comm.* (*Div. Wood Technol.*) *N.S.W.* 1 (10), 1946 (1–2).

Immunized Yellow Carabeen [*Sloanea woollsii*], White Birch (*Schizomeria ovata*], Bollywood [*Litsea reticulata*], Coachwood [*Ceratopetalum apetalum*] and Sydney Blue Gum [*Eucalyptus saligna*] are recommended as suitable substitutes in New South Wales for Oregon Pine. Their strength properties, and especially those of Yellow Carabeen, compare favourably with those of Oregon.

[268]. 31.0 : 12.25. **Specimen woods No. 135: Cilician Fir (*Abies cilicica*).** *Suppl.* to *Wood* 12 (3), 1947 (73–4).

[269]. 31.0 : 12.25 (94). LYNCH, C. **Australian Pines. Wide variety of uses for Hoop and Bunya timbers.** *Wood* 12 (2), 1947 (37–8).

Both Hoop Pine [*Araucaria cunninghamii*] and Bunya Pine [*A. bidwillii*] are used in the manufacture of veneers, plywoods, match boxes, match splints, battery separators and various household fittings. Hoop Pine has also been used in large quantities for butter boxes, after treatment with an anti-taint spray (a mixture of casein and formalin) developed by the Australian Council for Scientific and Industrial Research.

General notes are given on the natural range of both species and on the properties of their wood. Bunya wood weighs 28 lb. per cu.ft. as against 33 lb. for Hoop Pine. Because of its attractive colour, Bunya is sometimes preferred to Hoop, although its physical and mechanical properties are somewhat inferior.

[270]. 31.0 : 12.25 (51) : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of the wood of Leushan (*Cryptomeria japonica*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 14, 1944. pp. 6 + dgms. [Chin.]

[271]. 31.0 : 12.25 (51) : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of the wood of Yushan (*Picea asperata*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 4, [1942?] pp. 29. [Chin.]

[272]. 31.0 : 12.25 (922) : 31.27 : 31.42.11. SPOON, W. Grenenhout van Sumatra. **[Pine**

timber from Sumatra.] *Ned. Boschb.-Tijdschr.* 17 (2), 1944 (46—54). [Du.] (*Ber. HandMus. kolon. Inst. Amst.* No. 199.)

A brief review of published information on the occurrence and utilization of *Pinus merkusii* in the Netherlands East Indies, followed by a report on tests made at the Central Instituut voor Materiaalonderzoek, Delft, on its wood properties as compared with those of Scots Pine and American 'Pitch Pine'. The ranking of these timbers, in order of increasing strength, was: (*a*) *P. merkusii* sapwood; (*b*) *P. sylvestris* and heartwood of *P. merkusii*; (*c*) resinous wood of *P. merkusii*; (*d*) American 'Pitch Pine'. In a standard 12-week durability test, heartwood of *P. merkusii* lost rather less weight than that of *P. sylvestris* (14·8 and 19·8 per cent. respectively), when exposed to attack by *Coniophora cerebella*).

[273]. 31.0 : 12.26–8. **Specimen woods No. 134: Balsa (*Ochroma lagopus*).** *Suppl. to Wood* 12 (2), 1947 (434).

[274]. 31.0 : 12.26–8 (81). ALMEIDA, D. G. DE. **Note on a *Cordia* wood from Eastern Brazil.** *Trop. Woods* No. 89, 1947 (48–52).

A detailed description of timber of a species of *Cordia* from Eastern Brazil, known as 'Lauro', and a comparison of its microstructure with those of fully identified species of *Cordia*. Its physical properties closely resemble those of *Cordia goeldiana*.

[275]. 31.0 : 12.26–8 (51) : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of the wood of Houtaomu (*Juglans regia*) grown in Kweichow.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 12, 1944. pp. 6 + dgms. [Chin.]

[276]. 31.0 : 12.26–8 (94). **Properties of Australian timbers. Mountain Gum [*Eucalyptus dalrympleana.*]** *For. Prod. News Lett. C.S.I.R. Aust.* No. 148, 1947 (4).

[277]. 31.0 : 12.26–8. **The properties of Australian timbers: Mountain Ash [*Eucalyptus regnans*].** *For. Prod. News Lett. C.S.I.R. Aust.* No. 149, 1947 (7).

[278]. 31.0 : 12.26–8. **The properties of Australian timbers: Manna Gum [*Eucalyptus viminalis*].** *For. Prod. News Lett. C.S.I.R. Aust.* No. 145, 1946 (4).

[279]. 31.0 : 12.26–8 : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of the wood of Paotung (*Paulownia fargesii*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 13, 1944. pp. 6 + dgms. Bblg. [Chin.]

[280]. 31.0 : 12.29 (51) : 31.2. YEE, C. F., and SHEN, L. G. **[Properties of Nanchu (*Phyllostachys edulis*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 10, [1944?] pp. 40. [Chin.]

[281]. 31.0 : 12.29 (51) : 31.2. YEE, C. F., and SHEN, L. G. **[Properties of Szuchu (*Sinocalamus affinis*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 27, 1946. pp. 28. [Chin.]

31.1. *Structure. Anatomy. Identification*

See also *For. Abstr.* 9 (Nos. 6, 312, 395).

[282]. 31.1. **The preparation of wood for microscopic examination.** *Leafl. For. Prod. Res. Lab., P. Risborough* No. 40, 1946. pp. 8. P.R.

Directions are given for dealing with plywood, veneers and charcoals.

[283]. 31.1. FRANKLIN, G. L. **A rapid method of softening wood for microtome sectioning.** *Trop. Woods* No. 88, 1946 (35–6). [Forest Products Research Laboratory, Princes Risborough.]

In the course of experiments on the softening of so-called 'improved woods' (wood-resin composites) for sectioning prior to microscopic examination, it was found that heating in a mixture of glacial acetic acid and hydrogen peroxide softened both the wood and the resin [cf. *For. Abstr.* 6 (234)]. This method has now been satisfactorily adapted for the softening of very hard woods, such as Lignum Vitae, Iroko, etc.

[284]. 31.1 (7 : 8). HESS, R. W. **Identification of new world timbers.** *Trop. Woods* No. (86; 87; 88), 1946 (14–25; 11–34; 12–30 + plates).

Notes on species of Anacardiaceae and Annonaceae, with photomicrographic plates.

[285]. 31.1 : 12.25. **Key to the microscopical identification of the principal**

softwoods used in Great Britain. *Timb. Inform. Timb. Devel. Ass.* Ref. No. 25, 1946. pp. [7].

[286]. 31.1 : 12.25. PRESTON, R. D. **The fine structure of the wall of the conifer tracheid—I. The X-ray diagram of conifer wood.** *Proc. roy. Soc., Lond.* (*Ser. B.*) 133 (872), 1946 (327–48 + plate). [Univ. of Leeds.] O.B.D.

[287]. 31.1 : 12.25. PRESTON, R. D. **The fine structure of the wall of the conifer tracheid. II. Optical properties of dissected walls in *Pinus insignis*.** *Proc. roy. Soc., Lond.* (*Ser. B.*) 134 (875), 1947 (202–18). [Univ. of Leeds.] O.B.D.

[288]. 31.1 : 12.25 : 12.14.2. BOUREAU, E. Étude comparée des structures dites '*en clepsydre*' de l'appareil conducteur du *Libocedrus decurrens* Torr. et des *Clepsydropsis* carbonifères. [**Comparative study of the so-called 'clepsydra-like' structures in the conducting tissue of *Libocedrus decurrens* and of the Carboniferous *Clepsydropsis*.**] *Bull. Soc. bot. France* 91 (9), 1944 (217–24). [F.] O.B.D.

[289]. 31.1 : 12.25 : 12.14. BUDKEVICH, E. V. Anatomicheskoe stroenie vtorichnykh drevesiny roda *Pinus* L. v svyazi s ego sistematikoy. [**Anatomical structure of the secondary wood of the genus *Pinus* in relation to its systematics.**] In *Sbornik Nauchnykh Rabot . . . (1941–1943).* Botanicheski Institut im. V.L. Komarova, Leningrad. 1946. pp. 447–9. [Russ.] [Abstract of thesis.]

This study included 77 (24 from literature only) of the 84 species in the genus. The major correlations of external morphology and wood structure are: (1) Subgenus *Haploxylon*: bracts with non-decurrent base, leaves with one vascular bundle, ray tracheids smooth-walled; (*a*) Sections *Cembra* and *Strobus*—apophysis of cone scale with terminal umbo, leaf margin denticulate, side walls of ray cells with large pits; (*b*) Sect. *Paracembra*—apophysis thick, with smooth, dorsal umbo, leaf margin entire, side walls of ray cells with small pits. (2) Subgenus *Diploxylon*: bracts with decurrent base, leaves with two vascular bundles, ray tracheids mostly with dentate walls; (*a*) Sects. *Sula*, *Pinea*, and *Khasia*—branchlets uninodal, ray tracheids with walls feebly dentate to undulate or smooth; (*b*) Sects. *Eupitys*, *Banksia*, *Australes*, *Pseudostrobus* and *Taeda*—branchlets multinodal (except *Pseudostrobus*), ray tracheids with strongly dentate walls.

Further correlations noted were between variation in pit size on the side walls of the ray cells and length of cones and cones scales, length of leaves, and character of annual shoot growth. Variations in the end walls of ray cells also showed some correlation with seed characters (winged or unwinged seeds), and the presence of bordered pits on the tangential walls of tracheids with number of leaves in a fascicle.

Correlations between morphological and anatomical characters in *Pinus* are evidently of high taxonomic and phylogenetic significance. It is suggested that the number of sections might conveniently be reduced to two in *Haploxylon* (*Cembra* and *Strobus*; *Paracembra*) and to four in *Diploxylon* (*Eupitys*; *Pinea* + *Sula* + *Khasia*; *Banksia* + *Australes*; *Pseudostrobus* + *Taeda*).

[290]. 31.1 : 12.26–8 : 31.3 : 31.8. CHOW, K. Y. **A comparative study of the structure and chemical composition of tension wood and normal wood in Beech (*Fagus sylvatica* L.).** *Forestry* 20, 1947 (62–76 + plates). [Forest Products Research Laboratory.]

The staining reactions of the two types of wood are described. Chlor-zinc-iodine is a useful reagent for distinguishing tension wood, which is stained purplish or reddish-brown, from normal wood, which is yellow. Tension-wood fibres are characterized by short discontinuous spiral markings in the walls, which are here described for the first time. They are considered to be incipient tension failures, resulting from mechanical forces acting on the wood of the standing tree. Tension wood has a higher ash content, a higher solubility in water and a lower solubility in 1-per-cent. sodium hydroxide than normal wood. It is confirmed by chemical analysis that tension wood is less highly lignified and has a higher cellulose content and lower pentosan content than normal wood. The cellulose in tension wood is of longer average molecular chain length than the cellulose in normal wood. Evidence is given to support the view that the cellulose chain molecules in untreated tension-wood fibres, as compared with untreated normal wood fibres, are relatively more highly

orientated in the direction of the long axis of the fibres. The abnormal longitudinal shrinkage exhibited by tension wood on drying below the fibre saturation point is not, as hitherto supposed, associated with the angle of inclination of the cellulose fibrils in the wood cell-walls, but probably with the markings in the walls of tension-wood fibres. These markings are regarded as minute, transverse cracks indicative of a stretched condition in green tension wood, and their closing during drying accounts in large measure for the abnormal longitudinal shrinkage. *From author's summary.*

[291]. 31.1 : 12.26–8 (82). Cozzo, D. Anatomía comparada de las maderas argentinas del género *Erythrina* L. [**Comparative anatomy of the Argentine woods of the genus *Erythrina* L.**] *Darwiniana* 7 (2), 1946 (175–84 + plates). [Span.] O.B.D.

Deals with *Erythrina dominguezii, E. falcata* and *E. crista-galli.*

[292]. 31.1 : 12.26–8. Cockrell, R. A., and Monachino, J. **Supplementary notes on Cockrell's study of the wood structure of *Strychnos.*** *Amer. J. Bot.* 34 (1), 1947 (44). [New York Botanical Garden, New York.] O.B.D.

Cf. *For. Abstr.* 3 (50–1).

[293]. 31.1 : 12.26–8. **A confusing group of Eucalypts.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (6), 1946 (2).

The woods of *Eucalyptus microcorys, E. acmenioides, E. pilularis* and *E. maculata* are difficult to distinguish. The last-named may be identified by burning splinters or shavings, which leave a complete, soft ash. The other three species do not leave a complete ash; they can be distinguished by a test (which is described) for the presence or absence of waxy substances in extractives from their sawdust.

31.2. *Physical Properties*

See also *For. Abstr.* 9 (Nos. 265, 270–1, 275, 279–81, 396).

[294]. 31.2 (71). Rochester, G. H. **The mechanical properties of wood. A complete review of the mechanical properties of Canadian woods together with their related physical properties.** *Timber of Canada* 6 (Nos. 5–6, 8–12); 7 (No. 1), 1946.

31.22. Relation to Water, Air, Gases

See also *For. Abstr.* 9 (Nos. 305–7, 372, 432, 436, 454).

[295]. 31.22 : 33.15.5. Wasley, W. L. **The wetting of wood in various liquids and its relation to adhesion.** *Wood Prod.* 50 (6), 1945 (22, 24, 26). Biol. Abstr. 20 (1), 1946 (1628).

Evidence is offered that the adhesion of glue to wood does not depend solely on 'polarity' of the wood or glue. The wetting of wood with water and benzene, ethyl iodine, nitrobenzene, or the like, can be explained most satisfactorily by assuming the formation of hydrogen bonds between the water and the cellulose (or the adsorbed layer of water molecules already on the cellulose), while such liquids as ethyl iodine and benzene are incapable of forming hydrogen bonds either to the wood or to water molecules.

[296]. 31.22.1 : 07.7. **Low moisture content meter.** *Timber News* 55 (2092), 1947 (80). P.R.

This Swedish instrument is specially designed for low moisture content determinations in timber and other fibrous materials. It is claimed that measurements can be made with accuracy down to 0 per cent. Moisture content is determined at the surface of the material tested and the instrument does not record values at depths below $\frac{1}{4}$ inch.

[297]. 31.22.1 : 12.26–8. Vintilă, E. Cercetări asupra umidității lemnului de stejar în stare vesde. [**Researches into the humidity of Oak wood in the green state.**] *Repr.* from *Anal. Inst. Cerc. Exp. for. (Ser. I-a)* 9, 1943 (19–37). [Rum. f.] P.R.

Variations in moisture content of the green wood of an Oak (*Quercus robur*) aged 100 years were determined from 22 disks cut from the trunk at distances of 1 metre apart.

The results are shown in graphs and tables, and from them it was concluded that in the sapwood the moisture content varied between 60 and 90 per cent. and in the heartwood between 45 and 65 per cent.; it decreased on the whole from the foot to the top of the trunk, except in the sapwood from the foot to the first branching.

[298]. 31.22.1 (51). Yee, C. F., and Lo, Y. Y. [**The equilibrium moisture**

[306]. 31.27 : 12.25 : 31.22.1. DOYLE, D. V., MCBURNEY, R. S., and DROW, J. T. **The elastic properties of wood. The moduli of rigidity of Sitka Spruce and their relations to moisture content.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-B, 1946. pp. 6 + tbls. + figs. P.R.

This report presents values of the moduli of rigidity of solid and glued Sitka Spruce specimens at two values of moisture content as determined by tests performed at the Forest Products Laboratory, Madison. Summary tables are included, presenting average values for the three moduli of rigidity (^{G}LR, ^{G}LT, and ^{G}RT) and the ratios of these moduli to ^{E}L for each of 14 planks tested and for the species in general. A comparison of average values obtained from solid and glued specimens is also provided.

The values obtained from tests exhibited great variability among individual specimens. From the graphs that are included, showing the elastic constants plotted against the specific gravity of the specimens, it is apparent that no correlation with specific gravity was evident. The ratios of the G values to ^{E}L were also extremely variable and exhibited no correlation with specific gravity.

The values of the moduli of rigidity at two moisture contents indicate an increase in each of the three moduli with a decrease in moisture content. This trend conforms with previous investigations of other strength properties in their relationship with moisture.

A study of the reliability of using built-up plates by gluing together closely related pieces indicates that values obtained from solid and glued specimens do not differ significantly. *Authors' summary.*

[307]. 31.27 : 12.25 : 31.22.1. MCBURNEY, R. S., and DROW, J. T. **The elastic properties of wood. Young's moduli and Poisson's ratios of Douglas Fir and their relations to moisture content.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-D, 1946. pp. 8 + tbls. + figs. P.R.

This report presents data on the Young's moduli and Poisson's ratios of Douglas Fir as found from tests in compression at moisture content values of approximately 7, 13 and 20 per cent. A summary table is presented showing average values for each of four planks, and general averages for the three Young's moduli and their ratios, and for the six Poisson's ratios. Graphs are presented to illustrate the effects of moisture on the elastic constants. The Young's moduli and some of the Poisson's ratios are increased by a decrease in moisture content, while the reverse is true of other Poisson's ratios. The specimens covered only a small range in specific gravity and no correlation of elastic properties with specific gravity was apparent. *Authors' summary.*

[308]. 31.27 : 12.25. DOYLE, D. V., MCBURNEY, R. S., and DROW, J. T. **The elastic properties of wood. The moduli of rigidity of Douglas Fir at about 11 per cent. moisture content.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-E, 1946. pp. 5 + tbl. + figs. P.R.

The report gives values for the moduli of rigidity of Douglas Fir at approximately 11 per cent. moisture content. A summary table shows averages for each plank or block and grand averages of the moduli of rigidity in the three planes of elastic symmetry (^{G}LR, ^{G}LT, and ^{G}RT); the stress at proportional limit, maximum crushing strength and Young's modulus (^{E}L) of matching compression specimens; and the ratios of the three shear moduli to ^{E}L. Graphs relating the compressive strength and elastic properties to specific gravity are also included. The material used in these tests was selected to include a wide range in specific gravity. It exhibited a definite trend toward an increase of all properties studied with increase in specific gravity. The ratios of the moduli of rigidity to ^{E}L are variable and show no correlation with specific gravity. *Authors' summary.*

[309]. 31.27 : 12.26–8. DROW, J. T., and MCBURNEY, R. S. **The elastic properties of wood. Young's moduli, moduli of rigidity, and Poisson's ratios of Yellow Birch.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-H, 1946. pp. 4 + tbls. P.R.

This report presents values for the Young's moduli, the moduli of rigidity and the Poisson's ratios of Yellow Birch at about 13 per cent. moisture content. A table is given showing individual values and species averages of Young's moduli, the ratios ^{E}R/^{E}L and ^{E}T/^{E}L, and Poisson's ratios for 10 specimens (representing 6 or 7 logs) orientated in each of the 3 principal planes of elastic symmetry. Individual and average values are listed for the

three moduli of rigidity, representing 9 flat plates orientated in the direction of each of the 3 principal planes, but all taken from a single tree. Since the number of specimens of each type was insufficient, and the tests were conducted at only one moisture equilibrium, the effect of specific gravity and moisture content on the elastic constants could not be determined. *Authors' summary.*

[310]. 31.27 : 12.26–8. McBURNEY, R. S., DOYLE, D. V., and DROW, J. T. **The elastic properties of wood. Young's moduli, Poisson's ratios, and moduli of rigidity of Sweetgum at approximately 11 per cent. moisture content.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-F, 1946. pp. 9 + tbls. + figs. P.R.

The report gives values for the elastic constants of Sweetgum [*Liquidambar styraciflua*] at approximately 11 per cent. moisture content. As the material used in this study was taken from two different sources, this report is presented in two parts; Part A gives values for the three Young's moduli and six Poisson's ratios as determined in compression tests. Part B shows values for the moduli of rigidity of flat plates and the Young's modulus E_L of matching compression prisms. Summary tables are presented, showing average values of the elastic constants for each of several planks and logs, and likewise grand averages for the entire number of specimens. Graphs showing the moduli of rigidity and their ratios to E_L, plotted against specific gravity, are also included. Because of the extreme variability among specimens it was not found possible, in most instances, to determine upon a relationship between specific gravity and the elastic constants or their ratios. The logs from which test specimens were produced were free of common defects except for interlocked grain which is generally prevalent in Sweetgum. Much of the variability in test results is probably a result of such interlocked grain and can be considered typical for this species. Tests were conducted at only one moisture equilibrium, and the influence of moisture content on the elastic constants of Sweetgum has not been studied. *Authors' summary.*

[311]. 31.27 : 12.26–8. DOYLE, D. V., and DROW, J. T. **The elastic properties of wood. Young's moduli, moduli of rigidity and Poisson's ratios of Mahogany and Khaya.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-C, 1946. pp. 6 + tbls. + figs.

The values obtained from tests made at a single moisture content on Mahogany and Khaya, while based on a small number of specimens, indicated that the Young's moduli and the moduli of rigidity of each species increase with density, but show no relationship between Poisson's ratio and density.

Of the two species, Mahogany [*Swietenia* sp.] exhibited higher average specific gravity and correspondingly higher averages of Young's moduli and moduli of rigidity.

The ratios of the other elastic constants to E_L, while extremely variable for individual specimens, show little difference in average values for the two species. Poisson's ratio values were not consistently higher for either Mahogany or Khaya. *Authors' summary.*

[312]. 31.27 : 31.1 : 31.23 : 12.25. YLINEN, A. Über den Einfluss des Spätholzanteils und der Rohwichte auf die Festigkeits- und elastischen Eigenschaften des Nadelholzes. [**The influence of latewood ratio and density on strength and elastic properties of softwood.**] *Acta forestalia fennica* 50 (5), 1942. pp. 30. [G.fi.]

31.3. *Chemical Properties*

See also *For. Abstr.* 9 (Nos. 203, 290, 316, 382, 387, 390).

[313]. 31.3 : 31.22. CAMPBELL, W. G., and PACKMAN, D. F. **Chemical factors involved in the utilization of wood in association with metals.** Forest Products Research Laboratory, Princes Risborough, 1946. pp. 5. P.R.

In certain circumstances metals can be adversely affected by woods, and woods be attacked chemically as a result of close association with metals. Trouble can usually be obviated by intelligent selection of wood species, and proper seasoning of wood used in composite structures. Examples are given of (*a*) rapid erosion of ferrous and non-ferrous metals used in close association with wood (particularly Oak and Sweet Chestnut), and (*b*) chemical disintegration of wood arising as a direct result of contact with metals under undesirable conditions (e.g. wooden boats of double-skin construction in which the two

content of wood in China.] *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 24, 1945. pp. 28 + map + dgms. [Chin.]

[299]. 31.22.1 : 33.8. KENNEDY, E. I., KENNEDY, D. E., ATKINSON, J. H., and WAKEFIELD, W. E. **Study of temperatures and moisture contents attained in wooden aircraft wings in different climates.** Final Report. *Proj. For. Prod. Lab. Dom. For. Serv.* No. 239, 1945. pp. 25 + figs. + tbls. P.R.

[300]. 31.22.1 : 12.26–8 (729.5) : 31.43 : 13.2. PUERTO RICO. **Utilization of Puerto Rican woods.** *Rep. U.S. trop. For. Exp. Sta. 1946*, 1947 (26).

Untreated *Sloanea berteriana* heartwood was found to be free from teredo damage after 18 months in San Juan harbour. Testing of 203 seasoned samples of 81 local woods showed the equilibrium moisture content at Rio Piedras to be 14·6 per cent. Two Mangrove species (*Avicennia nitida* and *Laguncularia racemosa*) contained 19·0 and 15·3 per cent. moisture respectively, which suggests that the presence of salts in these woods may influence the moisture content.

[301]. 31.22.3 : 31.1. STAMM, A. J. **Passage of liquids, vapors and dissolved materials through softwoods.** *Tech. Bull. U.S. Dep. Agric.* No. 929, 1946. pp. 80.

An analysis is made of the passage of liquids, vapours and solutes through softwoods, considered on the basis of capillary structure. Equations have been formulated on the assumption that the diffusion is analogous to electrical conduction through the combined series and parallel combinations of capillaries. The structural variables, except for those depending upon the specific gravity of the wood, have little effect upon the diffusion values. Because of this, the calculated diffusion values seem to be practically independent of species. The diffusion of a solute into water-saturated softwoods in the longitudinal direction is almost entirely dependent upon the effective fibre-cavity cross-section. The diffusion in the transverse direction is primarily determined by the combined communicating capillary structure between the fibre cavities. As a consequence, the longitudinal diffusion varies inversely with changes in the specific gravity of the wood, whereas the transverse diffusion varies inversely as a complex function of the specific gravity. In the case of the diffusion of a solute into wood filled with a non-swelling solvent, the longitudinal diffusion is but slightly affected whereas the transverse diffusion is appreciably reduced, because the communicating capillary structure between fibre cavities is limited to passage through the pit structure.

The drying of wood below the fibre-saturation point or the absorption of a liquid from the vapour phase by wood is similar to the diffusion through liquid-filled wood except that:

(1) The different laminae of the wood in a direction at right angles to the drying or absorbing gradient will be swollen to different degrees, and consequently will have different capillary properties.

(2) Two different types of diffusion will be operative, namely, a bound-liquid diffusion through the cell walls under a liquid-content gradient and the diffusion of vapour through the coarse capillary structure under a vapour-pressure gradient. By converting to a common gradient basis, the combined diffusion for each lamina has been expressed in a single equation. At the lower temperatures and higher moisture contents the bound-liquid part of the diffusion predominates, while at higher temperatures, at lower moisture contents, and under reduced pressure the vapour diffusion predominates.

Average theoretical diffusion constants relative to the dimensions of the wood have been calculated for the drying of softwoods with different specific gravities under different boundary, temperature and pressure conditions.

The passage of a liquid through liquid-saturated wood with free liquid on the entrance and exit faces has been considered by applying capillary flow principles. Except in the case of porous sapwood, practically the total resistance to flow exists in the pit-membrane pores.

The passage of a liquid from or into wood under conditions where liquid-air menisci can be formed in the wood is shown to be complicated by surface-tension phenomena. The flow of virtually free liquid above the fibre-saturation point in the drying of normal green wood is controlled by the diffusion occurring in the zones below the fibre-saturation point.

In an appendix the physical and structural data used in calculations are compiled. *From author's summary.*

[302]. 31.22.3 : 33.36.1 : 12.25. THUNELL, B. Studier av inträngningen av vattenlösningar i furuvirke I. **[Studies of the penetration of aqueous solutions into Pine timber: I.]** *Medd. Svenska TräforsknInst. (Trätekn. Avd.)* No. 9, 1946. pp. 4. [Sw.] Repr. from *Trävaruindustrien* No. 17, 1946. P.R.

Penetration of 4- and 12-per-cent. $CuSO_4$ solutions was studied, using test pieces of Scots Pine at different moisture contents (room-dry, near fibre-saturation point, and water-soaked). Penetration was much greater in sapwood than in heartwood, and was most rapid longitudinally, much slower radially and slowest tangentially. In heartwood the rates of penetration were quite low and the difference between radial and tangential rates was not large. In sapwood, penetration was most rapid in specimens initially near fibre-saturation point and slowest in water-soaked wood, but in heartwood the wettest wood gave penetration rates greater than or at least as great as those of wood near fibre-saturation point, and room-dry wood showed the slowest rates. Four-per-cent. $CuSO_4$ generally penetrated more rapidly than the stronger solution but the latter gave the deepest penetration of wet sapwood. Rays and resin ducts were important lines of advance in penetration, which was most irregular longitudinally and most regular tangentially. There are microphotographs, tables and graphs in illustration of the results.

31.27. Mechanical Strength

See also *For. Abstr.* 9 (Nos. 272, 318, 350, 362–7, 372, 380–1, 509).

[303]. 31.27 : 07.2. KINGSTON, R. S. T. **Creep in timber. Report of investigations 1937–1946.** *For. Prod. News Lett. C.S.I.R. Aust.* No. 145, 1946 (1–2).

[304]. 31.27 : 12.25 (75.5). STERN, E. G., and NORRIS, E. B. **Strength properties of Red Spruce from West Virginia.** *Bull. Va. polytech. Inst.* 36 (8), 1943. pp. 26. [*Engng. Exp. Sta. Ser.* No. 55.] P.R.

Test data are presented on the strength properties of Red Spruce (*Picea rubra*), according to tests on small specimens cut from six bolts of three trees grown in Pocahontas and Randolph Counties of West Virginia, U.S.A. Correlation of these strength data with previous information on Red Spruce and Sitka Spruce from West Virginia showed such strength properties as to permit the structural engineer to use Red Spruce, similar to the Spruce under observation, as a substitute for Sitka and other aircraft Spruce. *From authors' summary.*

[305]. 31.27 : 12.25 : 31.22.1. DROW, J. T., and MCBURNEY, R. S. **The elastic properties of wood. Young's moduli and Poisson's ratio of Sitka Spruce and their relations to moisture content.** *Rep. U.S. For. Prod. Lab., Madison* No. 1528-A, 1946. pp. 11 + tbls. + figs. P.R.

The report presents data on the Young's moduli and Poisson's ratios of Sitka Spruce as found from tests in compression at moisture-content values of approximately 7, 13, 16 and 22 per cent. A summary table is presented showing averages for each of 14 plants and grand averages for the three Young's moduli and their ratios and for the six Poisson's ratios. Graphs illustrate the effects of moisture-content on the elastic constants and the relation of the elastic constants to specific gravity.

Although trends are somewhat obscured by variability among specimens, it appears that Young's moduli show some tendency towards increase with increase in specific gravity, whereas Poisson's ratios show no correlation. The three Young's moduli and their ratios, and the six Poisson's ratios are variously influenced by moisture. Each of the three Young's moduli increases with a reduction in moisture, but the increase is at a much greater rate for ^{E}R and ^{E}T than for ^{E}L; hence the ratios $^{E}R/^{E}L$ and $^{E}T/^{E}L$ increase with a decrease in moisture content. The four larger Poisson's ratios tend to decrease with a reduction in moisture, whereas the reverse is true of the two smaller ratios. The tests indicate that the two small Poisson's ratios, ^{U}TL and ^{U}RL, can probably be calculated more accurately from elastic-constant relations using measured values of related constants than they can be measured directly by available methods. *Authors' summary.*

E = Young's modulus; U = Poisson's ratio; R = In the radial direction; T = In the tangential direction; L = In the longitudinal direction.

chemical solutions. *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (9), 1946 (5).

On the whole, mineral acids (hydrochloric, sulphuric and nitric) caused most destruction, solutions of 25 per cent. and upwards causing complete disintegration of most species in a very short time. 25-per-cent. solutions of sodium hydroxide and 50-per-cent. solutions of hydrogen peroxide also completely destroyed most of the species tested, in a very short time. Inorganic salts had very little deleterious effect. In general the Kauris (*Agathis* spp.), Cypress Pines (*Callitris* spp.) and Celery-top Pine (*Phyllocladus rhomboidalis*) were markedly resistant to the attacks of chemical solutions. Of the hardwoods tested, the most resistant were *Eucalyptus grandis, E. saligna, E. marginata, Flindersia* spp. (especially *F. australis*), *Syncarpia laurifolia* and *Tristania conferta.*

31.8. *Quality and Defects of Timber*

See also *For. Abstr.* 9 (Nos. 185, 290, 350, 395, 513, 575).

[328]. 31.8 : 31.4 : 32.3 : 4. KNUCHEL, H. Défauts des bois. [**Defects of timber.**] Imprimerie Centrale, Lausanne. 2nd ed. (rev.), 1942. pp. 157. [F.] French edition translated by H. Badoux. P.R.

Cf. *For. Abstr.* 7 (No. 1824).

[329]. 31.8 : 31.46. CORMIO, R. Difetti dei legnami: Le alterazioni dei legnami dovute agli agenti atmosferici e ai fattori topografici. [**Defects of timber due to atmospheric agents and topographical factors.**] *Repr.* from *Ingegnere* Nos. 8–10, 1946. pp. 19. [It.] P.R.

Notes on a series of photographs of exhibits in the Siloteca Cormio at Milan. The following subjects are dealt with: the action of extreme heat and of prolonged drought; starshake; the action of extreme cold; double sapwood; ringshake (caused by wind and by mechanical action; means of recognising it in standing timber); false annual rings caused by prolonged drought; defects caused by the action of wind (ellipticity of trunk, compression wood, twisted fibre); defects caused by snow, ice and hail; the effects of exposure to air and water; and lightning damage.

[330]. 31.8 : 12.26–8 (47.1) : 12.19 : 33 : 32.81 : 56 : 54 : 44.3 : 2. BLUMENTHAL, B.-E. Studier angående aspens förekomst och egenskaper i Finland. [**Studies on the occurrence and properties of Aspen in Finland [with special reference to increment, length of clear bole, bark thickness, rot damage and its avoidance by silvicultural measures].**] *Silva fennica* No. 56, 1942. pp. 63. [Sw.g.]

[331]. 31.8 : 33.8 : 31.42.1. SCHEFFER, T. C. **Diagnostic features of some discolorations common to aircraft hardwoods.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 19, 1944. pp. 5.

32. HARVESTING OF WOOD. LOGGING

[332]. 32 : 01.6 : 33. **List of publications on logging, manufacture, and utilization of timber, lumber, and other wood products.** *Rep. U.S. For. Prod. Lab., Madison* No. R790, 1947. pp. 25. P.R.

[333]. 32 : 07.7 : 33.17. BREWER, A. F. **Lubrication of logging and sawmill machinery.** *Paper Tr. J.* 123 (23), 1946 (96, 100, 105, 110, 112, 118, 120). [Texas Co., New York.] P.R.

[334]. 32 : 38.2. SILVERSIDES, C. R. **Design and construction of logging camps.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 879 (B-3), 1946. pp. 19. [Pulp and Paper Research Institute of Canada, Montreal.]

Report on a survey conducted for the Pulp and Paper Research Institute for Canada. Recommendations are made for improved layout and sanitation. Portable camps, either skid mounted or panel type, have been found to offer advantages over permanent camps. There are numerous drawings on camp design showing plans and constructional details.

32.2. *Felling and Related Operations*

[335]. 32.25 : 82 : 33.01. Sahatukkien teosta aikatutkimuksen valossa. [**The time taken to produce sawlogs.**] *Acta forestalia fennica* 50 (19), 1942. pp. 8. [Fi.g.]

[336]. 32.25.4 : 07.7. ARO, P. Eräitä halkosahoilla suoritettujen sahauskokeiden tuloksia. [**Some results of experiments with hand frame-saws [on the best form and size of teeth, set, etc.].**] *Acta forestalia fennica* 50 (21), 1942. pp. 13. [Fi.g.]

[337]. 32.25.5 : 07.7. **The Astrom barker.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 863 (B-7-d), 1946. pp. 2.
Cf. *For. Abstr.* 7 (No. 1832).

[338]. 32.25.5 : 07.7. GOMENIOUK, G. **An analysis of hydraulic barking methods.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (188–90).
The writer concludes that wood difficult to bark requires a high-pressure, well-formed, solid, thin sheet of low traverse velocity, which utilizes an increased water supply by increase in its width while maintaining its thin dimension and traverse velocity. The jet should be thinner than the bark to be removed. Easily barked wood requires a low-pressure jet of high traverse velocity, which contains air, and, therefore, is not critical as to form. Increased water supply is utilized by increase of traverse velocity and/or jet width. The jet should be of the same thickness as the bark to be removed.

[339]. 32.25.5 : 24.31 : 32.22. WHITE, A. R. **Chemical treatment of live trees.** *Pulp Pap. Mag. Can.* 48 (2), 1947 (67–71).
The writer gives an account of the earlier experiments in poison girdling of trees to secure easy removal of bark, which led to the patenting of Cambicide, a paste composed of a 3 : 1 mixture of $CaCl_2/NaClO_3$ [cf. *For. Abstr.* 7 (No. 1245)]. More recent research has aimed at discovering a means of simultaneously (1) causing the bark to be removable at any season without the use of expensive machinery, (2) drying the tree so as to reduce the weight of pulpwood cut by at least 25 per cent., (3) reducing the quantity of undesirable substances (oleo-resins, etc.) in pulp made from green wood, by quick chemical seasoning, and (4) eliminating from the wood any residuum of chemicals deleterious to pulp. Ammonium sulphamate ($NH_4SO_3NH_2$) paste is applied after a ring of bark and $\frac{1}{4}$ inch of sapwood some 2 inches wide have been removed. The effects of poisoning are visible after the fourth day, and changes in the bark are significant after the first month. Black Spruce [*Picea mariana*] treated in October 1944 were felled in November 1945. The bark was soft and fell off with rough handling; the wood showed a loss of 28 per cent. in weight compared with untreated controls. Spruce cut and piled 3 weeks after treatment showed a loss of about 20 per cent. of weight, two months after treatment. Poplar, on the other hand, does not lose water nearly as rapidly if left standing. It dries from the inside outwards, so that much of the moisture is in the bark, which dies last. The bark of all species of Poplar will season after treatment as well piled as standing.
Experiments with sulphamic acid gave good results, but dichlorophenoxyacetic formulations were not promising.
A double-bladed girdling saw has been designed to make two saw cuts at the same operation. Using this tool, one man can girdle 200 trees in a 9-hour day.

32.7. *Loss in Logging. Incidental Waste*

[340]. 32.7 : 53. OBALIL, Z. Příspěvek k úvaze o započítávání ztrát při výrobě rovnaného dříví. **[On the calculation of losses in the production of stacked wood.]** *Lesnická Práce* 26 (1), 1947 (11–15). [Cz.e.]
The percentage volume losses that occur in making stacked wood are estimated at 3 for firewood (under 10 cm. diameter) barked on 2 sides, 5 for firewood (over 10 cm. diameter) barked on 4 sides, 7 for completely barked firewood, 10 for roughly barked pulpwood, 15 for pulpwood 'barked white' and about 3 for the retaining pickets of the stack. In addition, 5 per cent. excess height should be allowed for shrinkage when making a stack.

32.9. *Transport*

[341]. 32.91.1 : 07.7. En ny släpkälke. **[A new skidding shoe.]** *Skogsägaren* 21 (4), 1945 (78). [Sw.]
A brief note to accompany a photograph of the 'Klimax' combined skidding shoe and tongs (patent applied for) invented by V. Hedin. With this device there is no need to lift the butt of a log on to the shoe, as the log automatically comes into place when a pull is applied to the tongs. The tongs portion is detachable for separate use under special circumstances. Good results were obtained in trials of the device in winter extraction: it slides readily over stumps and stones and does not jam.

[342]. 32.92–4 (485) : 09.4. Flottningen under 1945. En redogörelse för de allmänna

skins are held together by metal nails). [Cf. *For. Abstr.* 6 (94).]

[314]. 31.3 : 31.42 : 12.21. VIRTANEN, A. I. **Fermentation of wood-dust by cellulose bacteria.** *Nature, Lond.* 158 (4022), 1946 (795). [Biochemical Institute, Helsinki.]

Fermentation of Birch, Aspen, and Pine dusts has been investigated at the Biochemical Institute, Helsinki, by means of enrichment cultures of thermophilic and mesophilic cellulose bacteria. It was found that the finer the wood was ground, the more of the cellulose was fermented. Results indicate the falsity of the earlier conception that the cellulose in wood is fermented only when lignin is in some way destroyed, and are evidence against the supposition that cellulose and lignin are chemically bound in wood. It is possible, however, that a linkage of this nature may be broken by the breaking of the long cellulose molecules by grinding. It seems probable that a part of the cellulose in wood is bound with lignin while a part is free, and this would explain why the whole amount of the carbohydrates in wood dust could not be fermented.

31.4. *Durability. Decomposition*

31.41. Natural Durability

[315]. 31.41 : 12.25 : 12.26–8. WECHEL, A. TE. Over de duurzaamheid van het hout van den douglasspar, den Sitkaspar en den Japanschen lariks. [**On the natural durability of wood of Douglas Fir, Sitka Spruce and Japanese Larch.**] *Ned. Boschb.-Tijdschr.* 16 (11), 1943 (444–5). [Du.]

In a 3-year graveyard test of natural durability, using sticks 1 × 1 × 20 cm., the percentages of decayed sticks of heartwood and sapwood respectively were: Poplar 99·5 and 98; Douglas Fir 1 and 5; Japanese Larch 10·4 and 92; Sitka Spruce 61 and 68. [Cf. *For. Abstr.* 1 (278); 9 (Nos. 428–9).]

31.42. Attack by Plant Organisms

See also *For. Abstr.* 9 (Nos. 54, 181, 272, 314, 319, 331, 540).

[316]. 31.42.11 : 12.25–8 : 12.21 : 31.3. WATERMAN, A. M. **The effect of water-soluble extractives from the heartwood of tropical American woods on the growth of two wood-decay fungi.** *Trop. Woods* No. 88, 1946 (1–11). [U.S. Bureau of Plant Industry.]

Tests were made of the toxic effect on the decay fungi, *Lenzites trabea* and *Poria microspora*, of the hot-water-soluble extractives from the outer heartwood of 11 selected species of tropical trees in comparison with 3 North American species. The toxicity of extractives from the tropical woods might be rated as follows: very toxic, *Clarisia racemosa*; toxic, *Chaetoptelea mexicana, Quercus copeyensis*; intermediate, *Persea pallida, Terminalia amazonia, Nectandra tectinervia, Ocotea tonduzii, Brosimum utile*; non-toxic, *Carapa guianensis, Rhizophora mangle, Humiria* sp. Extractives from *Pseudotsuga taxifolia, Robinia pseudoacacia* and *Quercus alba* indicate a decreasing toxicity in the order mentioned. According to service data, however, *R. pseudoacacia* is rated as highly durable, *Q. alba* as durable and *P. taxifolia* as intermediate. The results of the extractive tests with the tropical woods can be considered only as a very general indication of their relative decay resistance. *From author's summary.*

[317]. 31.42.11 : 12.26–8. VINTILĂ, E. Cercetări pe cale mycologică asupra durabilităţii naturale a lemnului de salcâm în comparaţie cu lemnul de stejar. [**Mycological studies on the durability of wood of Robinia compared with that of Oak.**] *Repr.* from *Anal. Inst. Cerc. for. Român.* (*Ser. I*) 10, 1944–45. pp. 25. [Rum.f.] P.R.

Specimens of Oak, Robinia and Beech were subjected to attack by *Polystictus versicolor, Coniophora cerebella, Merulius domesticus* and *Daedalea quercina.* Values are given for the losses in weight after 4 months; values for Robinia and Oak are also expressed as percentages of those for Beech. With *Coniophora* and *Merulius* the values for Robinia were somewhat lower than those for Oak, but other results indicate that Robinia is in general nearly as durable as Oak. [Cf. preceding abstract and *For. Abstr.* 9 (No. 190).]

[318]. 31.42.12 : 31.27 : 12.25 : 12.21. PETTIFOR, C. B., and FINDLAY, W. P. K. **Effect of sap-stain on the tensile strength of Corsican Pine sapwood (*Pinus nigra* var. *calabrica* Schneid.).** *Forestry* 20, 1947 (57–61). [Forest Products Research Laboratory.]

Tests have been made to determine the effects on the tensile strength of Corsican Pine sapwood of attack by *Ceratostomella* spp. and *Diplodia* sp., and also of general infection by various types of staining fungi. After 64 days' exposure, the loss in tensile strength due to attack by *Ceratostomella* spp. was 5–6 per cent. and that due to *Diplodia* sp. 17 per cent. After 94 days, the losses were 11–12 per cent. and 14 per cent. respectively. After 96 days, the loss due to the general infection amounted to 12 per cent. *From authors' summary.*

31.43. Attack by Animal Organisms

See also *For. Abstr.* 9 (No. 300).

[319]. 31.43 : 13.2 : 12.26–8 : 33.36.1 : 31.42. HOLMES, C. H. **Prevention and control of insect borers and fungal stains and decay of the timber of Malaboda (*Myristica dactyloides* Gaertn.).** *Indian For.* 73 (3), 1947 (107–17).

The wood of *Myristica dactyloides* in Ceylon is liable to damage by the borers: *Xyleborus semigranosus*, *Phloeosinus detersus*, *Minthea rugicollis*, *Heterobostrychus aequalis*, *Xylothrips flavipes*, *Crossotarsus minax* and *Batocera rubus*. The most important fungus is probably *Polystictus oestreiformis*. No protective measures have been found for logs, but decay and borer infestation in sawn logs can be prevented by brush coating with, or immersion in, lime wash or in solution of borax, Ascu, sodium silico-fluoride, Gammexane, or D.D.T., immediately after felling and sawing.

[320]. 31.43 : 13.2 (410). KAUFMAN, R. R. U. **Notes on the occurrence of *Hylotrupes bajulus* L. (Col., Cerambycidae) in the British Isles.** *Ent. mon. Mag.* 83 (993), 1947 (37–40).

Hylotrupes bajulus is a casual importation and is not an indigenous British species. Most of the British records refer only to isolated examples taken from timber in coastal, industrial and metropolitan areas where imported softwoods are likely to be found in bulk.

[321]. 31.43 : 13.2 (43.1–5) : 13.15. BECKER, G. Beobachtungen und experimentelle Untersuchungen zur Kenntnis des Mulmbockkäfers (*Ergates faber* L.). 2. Die Larvenentwicklung. [**Observations and experimental investigations on *Ergates faber* L. 2. The development of the larva.**] *Z. angew. Ent.* 30, 1944 (263–5). [G.g.] [Vierjahresplaninstitut für Werkstofforschung beim Staatlichen Materialprüfungsamt Berlin-Dahlem.]

[322]. 31.43 : 13.2. **A simple test for *Lyctus*-susceptible sapwood.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (7), 1946 (1–2).

A solution consisting of ¼ oz. iodine crystals, ½ oz. potassium iodide and 1 qrt. of water is sprayed or brushed on to a cut surface of wood (preferably a quarter-cut face), when sapwood containing a large proportion of starch turns a dark blue-black. Suggestions are made for the industrial application of this method.

[323]. 31.43 : 13.2 : 12.26–8 : 32.25.5. INDIA AND BURMA. [**Borers in *Boswellia serrata*.**] *For. Res. India Burma* Pt. 1, [1946?]

Attack on logs of *Boswellia serrata* by *Atractocerus reversus* may be prevented by removing bark completely after felling. Barked logs are vulnerable to Bostrychid attack but the damage so caused is negligible compared to that caused by *A. reversus*.

[324]. 31.43 : 13.2 (410). LAIDLAW, W. B. R. **On the appearance of the bark beetle *Ips typographus* in Britain on imported timber, with notes on preventive and control measures.** *Forestry* 20, 1947 (52–6 + plate).

[325]. 31.43 : 13.2 (69). KING, H. C. **Interim report on indigenous species in Mauritius.** Forest Department, Mauritius, 1946. pp. 21.

A list is given of termite-resistant indigenous timbers.

[326]. 31.43 : 13.2 : 33.36.1 (73). HOWELL, J. L. **The report of the termite committee.** *Pests* 14 (12), 1946 (46–7). D.S.I.R.

An account of a report made at the annual convention of the U.S. National Pest Control Association at New Orleans on October 29th, 1946. A revised form of the clauses concerning the fundamentals of subterranean termite control is set out in full.

31.44. Injury by Chemicals

[327]. 31.44 : 12.25–8. **Preliminary tests on timbers for use in contact with**

flottlederna.—Preliminära uppgifter för 1946. **[Timber-floating, 1945. A report for the public waterways.—Preliminary data for 1946.]** *Skogen* 34 (3), 1947 (42–3). [Sw.]

[343]. 32.92–4 : 07.7. SEPPÄNEN, O. Försök med lyftning av sjunktimmer. **[Experiment on the lifting of sunken logs.]** *Skogen* 34 (8), 1947 (125–7). [Sw.]

The Finnish experiment described was designed to test the effectiveness of 3 types of implement (figured): (*a*) an ordinary lifting pike; (*b*) the '*stockdrag*' (a small form of lifting tongs with a so-called 'balance board'); and (*c*) 3-armed grapple tongs, of which a light type mounted on a pole and a heavy one carried on a dragline, were tried. In shallow, clear water with a hard bottom the ordinary pike was the most effective and the light grapple tongs were almost as good. In turbid water and at depths exceeding 3 m., the best tool was the *stockdrag*, the grapple tongs also being suitable but not outstandingly so. A disadvantage of the pike is the hole left in the log, which may cause staining; further, the point of the pike sometimes breaks off in the wood. A special light pike-head (also figured) was devised as a result of the experience gained.

[344]. 32.92 (67.2) : 38.8. CERMAK, F. Le flottage des bois dans le bassin de l'Ogooué. **[Floating timber in the Ogowe basin.]** *Rev. int. Prod. Colon.* 22 (210), 1947 (61–4). [F.]

An historical account of the development of timber floating on the Ogowe River and its tributaries, which is the chief means of extracting Okoume, with suggestions for improvement works on the course of the river. It is emphasized that the regular flow of the river, on which timber floating depends, is in turn dependent on the maintenance of the 20 million ha. or so of forest in the catchment area, without which it would be subject to an alternation of floods and low water.

[345]. 32.92 (71) : 38.8. SILVERSIDES, C. R. **Long term planning for river drive improvements.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 874 (B-9-c), 1946. pp. 51 + figs.

The report was written to provide a guide in long-term planning for the use of rivers and streams in pulpwood driving. The principles of river improvement and water regulation are discussed. Methods of controlling eddies by side pins and booms, restricting the width of the river by side and centre piers, using sluices, spurs and groynes, and controlling water by dams are described and illustrated. The effect of cutting on the rate of snow melting and subsequent regulation of the runoff from a watershed is also taken into account. As an example a detailed account is given of a plan and estimated costs of improvements on the river Charles in the Gaspé Peninsula.

[346]. 32.95 : 33.02. SILVERSIDES, C. R. **Skidding of pulpwood over a suspended wire.** *Woodl. Sect. Index Canad. Pulp. Pap. Ass.* No. 877 (B-8-g), 1946. pp. 12. [Pulp and Paper Research Institute of Canada, Montreal.]

This report is based on a study made in 1946 to find out whether pulpwood can be delivered down steep slopes more economically over a suspended wire or cable than by methods at present in use. Details are given of the equipment and methods used. It has been found possible for two men to skid at a rate of 6–8 cords per day over distances up to 500 ft. on steep, rough sites where it is not possible to put a horse and where the methods at present in use have a very low production. It is recommended that the study should be continued in 1947 to develop a more satisfactory means of attaching pulpwood bolts to the wire. [Cf. *For. Abstr.* 7 (No. 792).] *From author's summary.*

[347]. 32.95 : 38.4 (44). PONCET, A. L'emploi du câble comme voie de vidange permanente. Une expérience : Le téléphérique forestier domanial de Saint-Hugon. **[The use of cable ways as a permanent means of transport. An experiment: the cableway in the national forest of St. Hugon.]** *Rev. Eaux For.* 85 (2; 3), 1947 (69–89; 161–71). [F.]

The design, materials, installation and cost of the cable-way are described and analysed. It is concluded that though in this instance a permanent installation was justified, there are not many forests in France where this would be true. The cable-way cannot in general replace the forest road though it has some definite advantages, e.g. in ability to handle exceptionally long logs, ease of maintenance, and capacity to continue working during winter.

33. CONVERSION AND PRESERVATION OF WOOD

See also *For. Abstr.* 9 (No. 332).

[348]. 33 (485) : 07.2. SUNDBLAD, G. Skogen och träforskningen. [**The forest and research in wood technology.**] *Svenska SkogsvFören. Tidskr.* 45 (2), 1947 (64–76). [Sw.]

A lecture outlining the history of wood research—particularly that on the chemical utilization of wood—in Sweden, and dealing on broad lines with the organization of the newly-established Wood Research Institute and research in progress or envisaged there. [Cf. *For. Abstr.* 8 (No. 1778).]

[349]. 33 (52) : 09.4. **Lumber production in Japan.** *Rep. Brit. Intell. Obj. Sub-comm.* No. BIOS/JAP/PR/699, 1946. pp. 32. P.R.

[350]. 33 : 06.2 : 33.91 : 31.27 : 33.7 : 33.32 : 33.33 : 31.8 : 12.26–8. MORÄTH, E. [Editor]. Die zweite Tagung des Internationalen Ausschusses für Holzverwertung der Internationalen Forstzentrale. [**Second session of the International Committee for Wood Utilization of C.I.S.**] *Silvae Orbis* No. 15, 1944. pp. 259. [G.] X.

The proceedings of this conference, held at Stresa on 24th–28th May, 1943, include the following papers:—*F. Kollman* on the background, work and aims of the International Committee for Wood Utilization (pp. 16–29); *G. Sala* on the standardization of commercial practice in the international timber trade (pp. 30–40); *O. Graf* on German standards for constructional timber (pp. 41–59); *F. E. Siimes* on some results of investigations of the strength of Finnish sawn timber, with special reference to the effects of knots and specific gravity (pp. 60–71); a series of contributions (by *A. Ylinen, F. Kollman, H. Hörig, J. Campredon, G. Sala* and *G. Giordano*, and *Lobry de Bruyn*) towards a draft standard procedure (reproduced in full) for testing the mechanical properties of wood (pp. 72–134); *L. Moser* on economic and technical problems of wood as a fuel (pp. 135–45); *H. G. Winkelmann* on peculiarities of wood as a fuel and the present state and possibilities of improvements of technique (pp. 146–70); *G. Sirakow* on possibilities of economies in the use of wood fuel in Bulgaria (pp. 171–7); *G. Jayme* on the production and properties of hardwood pulps (pp. 178–212); *K. Lauer* on the production and properties of textile cellulose fibres from hardwoods (pp. 213–21); *E. Moräth* on red heartwood of Beech (pp. 222–6); *H. Mayer-Wegelin* on heartwood formation in Beech (pp. 227–36); *E. Hägglund* on the relations between silvicultural measures and pulpwood quality (pp. 237–41); and *W. Klauditz* on the types of research necessary for the clarification of relations between silvicultural treatment and pulpwood quality (pp. 242–59).

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

[351]. 33.1 : 07.7. WALTERS, C. S. **The use of two types of mine-detectors as locators of metal in sawlogs.** *J. For.* 45 (3), 1947 (198–200).

The U.S. War Department's mine detector SCR–625–H (mutual inductance bridge type) can be used within certain limits for the detection of metal in sawlogs. It will not detect lead and the limit of detection of ferrous metals is about 5 in.

[352]. 33.1 : 07.7. **X-raying of timbers to save saws.** *Timberman* 48 (6), 1947 (39).

A successful experiment in X-raying timber to discover foreign bodies has recently been carried out by the Robert Gray Shingle Co. of Hoquiam, Washington, using a specially built, portable X-ray fluoroscope unit mounted on wheels. All metal objects, stones, and pitch pockets were readily seen. In order to mark the location of the foreign bodies, the operator presses a button which sprays a spot of yellow paint over the embedded object. The marked sections of timber are then cut out before running through the resaw. The fluoroscope will successfully locate objects in the timber to a depth of 18 in. The cost of the experimental model was about $5,000.

[353]. 33.1 : 07.7 (43.1–5). CROSBY, T. S., and FARTHING, F. J. **Manufacture of woodworking machine tools in the American and French zones of Germany.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1040, [1946?]. pp. 8. P.R.

Only two types of machine were considered noteworthy. These are the knot-hole borer and plugger and the veneer patcher manufactured by R. Raimann, Freiburg.

Use of Wastes

See also *For. Abstr.* 9 (Nos. 421, 425, 455).

[354]. 33.1 : 34.6 : 33.36.1 : 33.31. YOUNG, W. **The effect of lime on clinker formed in furnaces burning boric acid impregnated planer shavings.** *Aust. Timb. J.* 12 (12), 1947 (690, 693, 700–1).

At an impregnating plant for the treating of timber with boric acid, the waste material produced in dressing the treated planks is used as fuel in the boiler furnace. Burning of this material formed a glassy slag which cemented the firebars together and prevented the efficient operation of the boiler. A new set of firebars had to be replaced after 3 weeks' operation. Tests showed that combustion is improved by adding lime to the wood waste. The optimum rate appeared to be about 68 lb. of hydrated lime per ton of planer shavings. The wood waste, which was mainly Brown Tulip Oak (*Tarrietia argyrodendron*), contained 1·5 per cent. boric acid. The cost of this treatment of the fuel at the suggested optimum rate, assuming lime at 3s. 9d. per 50 lb., is 4d. per 100 sq. ft. of 4 × 1 in. timber treated

33.12. Joinery, Turnery

[355]. 33.12 : 07.7. HAYCOCK, A. H. **Alternative routing methods.** *Wood* 12 (2; 3), 1947 (54–7; 84–7).

33.13. Cooperage

[356]. 33.13 (82) : 12.26–8. TINTO, J. C. Evolución de la industria tonelera argentina a base de maderas indigenas. [**Evolution of the Argentine cooperage industry based on indigenous woods.**] *Publ. tec. Direcc. for. Argentina* No. 8, 1946. pp. 47. [Span.]

Includes a brief history of the Argentine cooperage industry, data on the importation of wine casks into Argentina, the use of indigenous Argentine woods for cooperage, the exploitation and treatment of cooperage timber, the characteristics of Algarrobo (*Prosopis alba* and *P. nigra*) barrels and containers as compared with those of North American Roble (*Quercus alba*) and the manufacture of containers for products other than wine.

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

[357]. 33.15 : 01.6. **List of publications on glue and plywood.** *Rep. U.S. For. Prod. Lab., Madison* No. R513, 1947. pp. 13. P.R.

A revised list [cf. *For. Abstr.* 7 (No. 1855)].

33.15.1. *Manufacture of Veneers and Laminated Wood*

[358]. 33.15.1 (44). BALLOUX, M. L'industrie française des panneaux contreplaqués. [**The French plywood industry.**] *Rev. int. Bois* 14 (116), 1947 (42–4). [F.]

[359]. 33.15.1 (52) : 09.4. **Veneer and plywood manufacturing in Japan (preliminary report).** *Rep. G.H.Q. Supreme Commander Allied Powers nat. Resour. Sect.* No. 34, 1946. pp. 55. P.R.

Production of plywood in Japan has steadily declined from 830,000,000 sq. ft. in 1940 to 95,000,000 sq. ft. in 1945. Although actual capacity is 27,500,000 sq. ft. per month, present production is 12,000,000 sq. ft. Stockpiles now total 3,214,000 sq. ft., of which 87 per cent. is in Hokkaido, far from the major consumer centres. Log and glue shortages are the chief causes for the closing of 51 factories, and there are also labour difficulties. A survey is made in the report of the whole of the Japanese plywood industry—distribution, prices, logging methods, and plywood and glue manufacture. Figures are given for actual plywood production and capacity, prices, standard sizes, etc.

[360]. 33.15.1 (68). **Plywood and veneer in South Africa.** *Industr. Ref. Serv. U.S. Dep. Comm.* 4 (Part 6, No. 47), 1946. pp. 3.

War-time conditions gave an impetus to the expansion of the South African plywood industry. Average imports for 1934–39 amounted to about 26,000,000 sq. ft. a year. By 1943 plywood imports had declined drastically. Production of plywood in South Africa now amounts to about 14,000,000 sq. ft. a year, most of which is produced in a plant in Capetown. Species used are mainly Okoume from French West Africa and Kiaat from the

Belgian Congo and British East Africa. Other species include Limba, Iroko, Agba, African Walnut, Stinkwood, Birch and Teak. A brief account of the industry is given and tables give figures for U.S. exports of timber to South Africa and Mozambique from 1933–45, and plywood imports of the Union of South Africa from 1939–42.

[361]. 33.15.1 (71) : 35 : 98.3. **Plywood and veneers: war-time development of the industry in Canada.** *Cabinet Mkr.* No. 2466, 1947 (97–8). *Repr.* from *Board of Trade Journal.* P.R.

A short review of the Canadian plywood and veneer industry during and since the war. On the West Coast, mills are concentrated mainly around Vancouver and New Westminster. They produce plywood consisting principally of Douglas Fir, with smaller quantities of Western Hemlock, Western Red Cedar, Cottonwood, Poplar, Pine and Sitka Spruce. Total annual production of Douglas Fir plywood is estimated at about 225,000,000 sq. ft. Mills in Eastern Canada are widely distributed over an area extending from Lake Huron to the Bay of Fundy. There are 19 mills with an annual production of about 235 million sq. ft. of veneer and 155 million sq. ft. of plywood. They concentrate on the production of both plywood and veneers of Birch, with smaller quantities of Maple, Basswood, Elm, Oak, Poplar and imported Walnut, Mahogany and other exotic woods. A table gives the values of exports of veneer and plywood during the years 1936 to 1946 (January-August).

[362]. 33.15.1 : 12.29 : 31.27. YEE, C. F., LO, C. H., and HWANG, C. B. **[Plybamboo.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 26, 1945. pp. 52. [Chin.]

33.15.2. *Use of Plywood and other Laminated Wood*

See also *For. Abstr.* 9 (No. 420).

[363]. 33.15.2 : 31.27. LISKA, J. A. **Methods of calculating the strength and modulus of elasticity of plywood in compression.** *Rep. U.S. For. Prod. Lab., Madison* No. 1315 (rev.), 1946. pp. 4. P.R.

A revision of a progress report first published in 1942, presenting a method for calculating the compressive strength and moduli of elasticity of plywood. This method is based on tests which to date have been limited to (1) plywood in which the grain of the alternate plies is at right angles, (2) loading conditions in which the compressive stress is either parallel or perpendicular to the direction of the grain of the face plies, and (3) plywood in which all plies are of the same species. The formulas and discussion relate to members or specimens of such size and supporting conditions that the compressive strength is the controlling factor; accordingly the data are not applicable to plywood columns or plates where buckling is the controlling factor.

[364]. 33.15.2 : 31.27. BENSEND, D. W., and PRESTON, R. J. **Some causes of variability in the results of plywood shear tests.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1615, 1946. pp. 10 + tbls. + figs. P.R.

A study was made to determine some of the causes of variability in plywood shear-strength measurements. Misalignment of the upper and lower jaws of the testing machine by as little as ½ mm. resulted in large differences in dry shear strengths. The full length of the upper jaws should be in contact with each specimen. The jaws should be always tightened to about the same extent. Only straight-grained veneer should be used for the face plies of shear test specimens used for testing the quality of glues in dry joints. Variations in the depth of the saw cuts resulted in important variations in shear-strength values. Shear strengths were greatly affected by the moisture content of the specimens at time of testing and a careful control should be kept on moisture contents. It is important to match carefully the face plies of comparative panels and to test an equal number of specimens from each panel for every testing variable being investigated. *From authors' summary.*

[365]. 33.15.2 : 31.27. SMITH, C. B., HEEBINK, T. B., and NORRIS, C. B. **The effective stiffness of a stiffener attached to a flat plywood plate.** *Rep. U.S. For. Prod. Lab., Madison* No. 1557, 1946. pp. 28 + tbls. + figs. P.R.

The report gives a mathematical analysis of the effective stiffness of a stiffener attached to a flat plywood plate. The analysis yields formulae for computing the stiffness added to a plywood plate by gluing a stiffener to one face of the plywood. The data obtained from

107 tests of 17 plates with stiffness of differing depths supply reasonable confirmation of the analysis. Summary for the case in which both plate and stiffener are of isotropic material is also included. *From authors' summary.*

[366]. 33.15.2 : 31.27 : 38.2. McKEAN, H. B. **Mechanical properties and design procedure for glued laminated beams composed of two wood species.** *Bull. Mich. Sch. For.* No. 11, 1944. pp. 55 + tbl.

Several types of beam made of two species of wood with laminations of varying thickness were subjected to strength tests. The method of manufacture, tests and results are described and discussed. Such laminated beams offer many advantages over solid wood and over metal. Almost any combination of woods may be effectively used as long as the core wood is light in weight, and the wood of the laminations is very strong.

[367]. 33.15.2 : 31.27 : 38.2. COUNTRYMAN, D. **Structural application of plywood. Part IV. The fabrication and testing of full scale plywood beams.** *Rep. Douglas Fir Plyw. Ass.* No. 30, 1944. pp. 26. P.R.

The fourth of a series of reports dealing with the structural design of built-up plywood beams and girders. Included are the design data, the experience in fabrication techniques and costs, test methods and data, and the characteristics of failure of a series of thirteen 25-foot beams with plywood webs and lumber flanges. Beams of both box and I-beam sections, with depths ranging from 18 to 36 inches and design loads from 9,000 to 30,000 pounds on third point loading were investigated. Most were shop-fabricated with glued construction, but some were field-fabricated with nail-glued assembly, and one was nailed only. Cost data are inconclusive owing to the small number of each type of beam built, but such plywood beams appear to be at least competitive with equivalent laminated lumber construction. Among the more important test observations are the facts that deflections were predicted with reasonable accuracy and that beams behave according to theory. There was no evidence of lateral instability of the beams, and no buckling or horizontal shear failure of the plywood webs. No reduction of design stress for either scarfed plywood panel joints or for butt joints with plywood web splices was indicated. Despite inferior gluing of some beams due to cold-room curing conditions, the minimum factor of safety on the design load was in excess of 3, and the average for all beams above 4. *From author's abstract.*

[368]. 33.15.2 : 33.4. MOON, C. L., and WAKEFIELD, W. E. **Some developments in hardwood surfaced laminated flooring.** *B.C. Lumberm.* 31 (4), 1947. (91–2, 98–9). [Forest Products Laboratories, Ottawa.]

The Forest Products Laboratories of Canada have been experimenting with four types of hardwood-surfaced laminated flooring: (1) conventional-type floor boards made from $\frac{3}{8}$-in. softwoods, faced with $\frac{1}{8}$-in. Birch veneer; (2) a non-load-carrying panel type made from $\frac{1}{8}$-in. Birch veneer with a $\frac{1}{8}$-in. Pine veneer core and a $\frac{1}{8}$-in. Pine veneer back, the grain of the core being laid transverse to that of the face and back; (3) similar to type (1) except that the backing board is of sufficiently good grade to permit the floor to be load-carrying. The back boards $\frac{7}{8}$-in. thick and the face is of $\frac{1}{8}$-in. hardwood veneer; (4) a load-carrying type consisting of a $\frac{3}{4}$-in. core of low-grade softwood, edge-glued to form a panel. One-eighth-inch Birch veneer is glued to the back and face with grain transverse to that of the core. In general the panels stood up well to testing and appear to be practicable for the construction of floors. They are not unduly affected by exposure to severe humidity at relatively high temperatures. In this respect the panel types of flooring (2) and (4) are superior. Strength tests on the load-bearing types indicate that the laminated floor having the Birch face and Spruce or Pine backing parallel has the greater strength, but both types of load-bearing floor are so much over strength that the strength of the supporting joists, and not that of the floor, is the critical factor. Preliminary estimates of the costs of the various types of flooring indicate that the costs of the non-load-carrying types are about the same as for standard hardwood flooring, while load-carrying types appear to be somewhat cheaper when the cost of a sub-floor is taken into account.

[369]. 33.15.2 : 33.8 : 31.22.1. HEPTING, G. H. **Temperature and moisture relations in plywood aircraft structures.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 20, 1944. pp. 4 + tbl. + figs.

Experiments to determine whether free water of condensation forms inside the airfoils of wooden aircraft on the ground indicated that formation is unlikely under normal conditions, but the evidence is not conclusive. [Cf. *For. Abstr.* 9 (Nos. 298–9).]

33.15.3. *Improved Woods*

See also *For. Abstr.* 9 (No. 383).

[370]. 33.15.3 : 12.25–8. STARK, E. W. **The molding of Compreg, Impreg, Papreg, and related products under heat and pressure.** *Rep. Purdue Univ. agric. Exp. Sta.* 1945 (57).

Samples of Cottonwood [*Populus* sp.], Hackberry [*Celtis* sp.], Ponderosa Pine, Soft Maple [*Acer saccharinum*] and Yellow Poplar [*Liriodendron tulipifera*] were tested for resin absorption by simple soaking. Results indicated that Ponderosa Pine cannot be moulded satisfactorily, owing to its high natural oleoresin content; Soft Maple is relatively too hard to permit of easy moulding; Hackberry moulds more readily than Soft Maple, owing to more uniform distribution of resin; Yellow Poplar with a high proportion of heartwood does not mould satisfactorily, since most of the resin is concentrated in the sapwood; Cottonwood shows the most promise, but drying after soaking presents some difficulties and there is a tendency towards checking of the heartwood during the process.

[371]. 33.15.3 : 12.26–8 (47.1) : 33.8. [HIETA, P.] **A Finnish product.** *Timb. Tr. J.* 180 (3674), 1947 (407–8).

An account of Koluwood, an impregnated, laminated Birchwood material developed in the Finnish State Aircraft Factory for the manufacture of aircraft propellers.

[372]. 33.15.3 : 31.22.2 : 31.27. CLARK, G. L., and HOWSMAN, J. A. **Swollen, impregnated, and compressed wood samples: X-ray diffraction studies.** *Industr. & Engng. Chem.* (*Industr. Ed.*) 38 (12), 1946 (1257–62). [Univ. of Illinois, Urbana, Ill.] P.R.

The swelling of wood and ramie fibres by pyridine and morpholine was studied. The agreement of calculated values of the lattice dimensions of untreated and swelled specimens indicated that no compound formation between the cellulose and the molecules of the swelling agent had taken place. The swelling of wood by both pyridine and morpholine was classified as intermicellar. The technique of microradiography was applied to the study of impregnated wood. An improved procedure was developed for making microradiographs of wood. The microradiographs were found to be characteristic of the wood and the distribution of the impregnant. A comparison of the relative effectiveness of alcohol-soluble and water-soluble resins as impregnants was possible by this technique. The alcohol-soluble resins were more evenly distributed on the cell walls of the wood after preliminary swelling with morpholine than were water-soluble resins and, therefore, were probably more efficient in decreasing dimensional changes with changes in humidity. On the other hand, the water-soluble resins are more evenly distributed after vacuum treatment of the wood and impregnation under pressure. The orientation of cellulose crystallites in wood which had been subjected to heat and pressure was studied and compared with the orientation in untreated wood. For this purpose a microphotometer with a new rotating stage was used for graphical evaluation of X-ray patterns. In general, compression of wood seems to decrease the preferred orientation of the cellulose crystallites, whereas the preferred orientation of heated wood increases as a result of heat treatment. Absolute correlation between changes in orientation and physical properties of wood are not complete, but heat treatment with attendant increase in preferred orientation improves tensile strength by 10 per cent. or more. *Authors' summary.*

33.15.5. *Glues and Gluing*

See also *For. Abstr.* 9 (No. 295).

[373]. 33.15.5. WANGAARD, F. F. **Tests on the durability of woodworking glues.** *Sth. Lumberm.* 174 (2184), 1947 (63–72). [Forest Products Laboratory, Madison, Wis.]

A report, based largely upon a war-time summary, on the durability of aircraft glues [cf. *For. Abstr.* 7 (No. 1289)] which brings together in convenient form for reference the available laboratory data on the durability of the principal woodworking glues.

[374]. 33.15.5. RUDKIN, A. W. **Synthetic resin adhesives. IV. Phenol-formaldehyde resins.** *For. Prod. News Lett. C.S.I.R. Aust.* No. 148, 1947 (3–4).

[375]. 33.15.5 (43.1–5). KLINE, G. M. **I.G. Farbenindustrie, Uerdigen.** *Rep. comb. Intell. Obj. Sub-comm.* No. XXVII–39, Item No. 22, [*n.d.*]. pp. 19. P.R.

The report contains data on the composition and use of glues manufactured by I.G. Farbenindustrie. These include pyroxylin glues (Cohesan), polyvinyl ether glues (Cosal), ureaformaldehyde glues (Kaurit), and polysocyanate resins (Polystal).

[376]. 33.15.5 : 07.7. GELLAY, V. P., and LACEY, P. M. C. **Setting of synthetic resin adhesives by radio frequency methods. Report No. 1.** Harris Lebus Laboratory and Forest Products Research Laboratory, Princes Risborough. 1943. pp. [8] + figs. P.R.

The work was originally planned to determine whether the rapid heating induced by the radio-frequency method had any adverse effect on the setting of synthetic-resin adhesives. All glues approved to Specification D.T.D. 484 were to be checked by setting in a 0·05-in. gap joint by an R.F. field and tested mechanically for joint strength. The initial experiments showed, however, that it was technically impossible to adhere to these terms of reference; but the preliminary work has shown the following:—

(1) Suitable assembly arrangements for applying the R.F. field in either the transverse or glue-line direction have been devised for the materials to be used in further experiments. Air-gaps in the glue-line method were found to be a hindrance, not a necessity.

(2) Temperature measurements cannot be made continuously by thermocouples, using a generator with unbalanced output voltage, which means that the temperatures measured in the glue-line method are uncertain.

(3) It was found impossible to set either Beetle A with yellow hardener or Aerolite 300 with G.B.P. (separate application) in an 0·05-in. gap by either transverse or glue-line R.F. heating. This, however, could not be done even in a hot press at 200° F. for 1 hour.

(4) The maximum thickness of Beetle A or Aerolite 300 glue-line which could be set in the hot press within ½ hour was of the order 0·015 in. and for the glue-line R.F. method about 0·02 in.

(5) Catacol (with 14½ per cent. accelerator) is easily set by transverse R.F. in any thickness of glue-line up to 0·05 in., but it gives trouble in glue-line heating owing to lowered viscosity when hot, and whenever there are irregularities in the glue-line thickness these lead to overheating, bubbling and then charring.

[377]. 33.15.5 : 07.7. HORNE, R., and ANDERSON, R. **Radio-frequency gluing—a new development in wood utilization.** *For. Cl. Quart.* 20 (2), 1946–47 (12–16).

A report of a two-day conference held at the College of Forestry, University of Washington, Jan. 16–17, 1947.

[378]. 33.15.5 : 07.7. MILLER, D. G. **Radio frequency bonding of laminated beams.** *Timber of Canada* 7 (8), 1947 (57–61). [Forest Products Laboratories, Ottawa.]

The principal features of radio-frequency heating for bonding laminated beams are reviewed, and a description is given of a practical electrode system which was developed at the Forest Products Laboratories, Ottawa. The usual method of applying radio-frequency power for bonding wood is the transverse heating electrode arrangement, in which the radio-frequency field is perpendicular to the glue line. This method is eminently suitable for bonding plywood and similar wood products where the volume of wood is small compared with the area of wood to be glued, but in the case of heavy laminated beams an exorbitant amount of power must be expended to heat the large volume of wood to the glue-curing temperature. For this purpose, a parallel heating electrode arrangement in which the radio-frequency field is parallel to the glue line has the advantage of facilitating the concentration of power where the heat is actually required. The system here described substitutes, for plate electrodes, metal bars ½ in. to ¾ in. wide, mounted and spaced so as to be centred about individual glue lines. Calculations of curing time and cost are presented for a beam of dimensions 12 in. × 24 in. × 24 ft., consisting of 15 laminations of 1⅝-in. Spruce bonded with modified phenolic glue requiring a curing temperature of 220° F. The total bonding time, if only 15 kw. are available, would be 50–60 minutes and the cost $1.80.

[379]. 33.15.5 : 12.25. **The gluing of White Cypress Pine (*Callitris glauca*).** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (10), 1946 (3).

Tests made with glue joints of Cypress Pine and 3-ply panels of Cypress Pine core and Coachwood, showed that Cypress Pine can be satisfactorily bonded with either urea or phenol formaldehyde.

[380]. 33.15.5 : 31.27. CHELMEZIU, N. **Încercări comparative pentru determinarea rezistentei încleieturii pieselor de lemn din diferite specii. [Comparative studies to determine the strength of glued joints of wood of different species.]** *Repr.* from *Bul. Soc. polit., Bucureşti* 58 (9–12), 1944 (350–86). [Rum.] P.R.

[381]. 33.15.5 : 31.27. EICKNER, H. W., MRAZ, E. A., and BRUCE, H. D. **Resistance to fatigue stressing of wood-to-metal joints glued with several types of adhesives.** *Rep. U.S. For. Prod. Lab., Madison* No. 1545, 1946. pp.. 5 + tbls. + figs. P.R.

Lap-joint specimens, prepared by gluing strips of metal to wood by 7 different processes, were stressed repeatedly with constant deflection in an electrically-driven machine until each had either failed or withstood 10 million vibrations without failure. The results are tabulated. Highest resistance was shown by the following 2 processes: (1) a hot-setting mixture of thermosetting resin and synthetic rubber was applied in 6 coats to the metal and wood by spraying (5 minutes allowed for drying between the coats), dried at room temperature for 16 hours, baked in an oven at 180° F. for 45 minutes, assembled and cured at 320° F. for 25 minutes under a pressure of 300 lb./sq. in.; (2) a thermosetting combination of synthetic rubber and plastics was sprayed on to the metal in 10 double passes, a 10-minute flash-off period being allowed between coats, and the last coat being allowed to air-dry for 3 hours before assembly. Two thin coats of a modified low-pressure thermoplastic resin were applied by brushing to the wood, with a 10-minute period between coats and about 3 hours air-drying before assembly with the primed metal. The joint was then cured for 35 minutes at 340° F. under a pressure of 150 lb./sq. in.

[382]. 33.15.5 : 31.3. DEMARCO, F. A., and SMITH, E. A. **Determination of the relative acidity of wood and adhesive joints.** *Industr. & Engng. Chem.* (*Anal. Ed.*) 18 (12), 1946 (775–7). P.R.

The pH of any wood species is closely related to its moisture content and wood structure. The use of fluorescent dyes as pH indicators for plywood is impracticable, but it is possible to determine the relative pH of wood by the use of ordinary colour indicators. The pH of light-coloured glues was also measured, even after setting. Colour indicators yielded valuable information regarding pH and glue penetration in plywood.

[383]. 33.15.5 : 33.15.3. EICKNER, H. W., and BRUCE, H. D. **Gluing of thin Compreg.** *Rep. U.S. For. Prod. Lab., Madison* No. 1346 (rev.), 1946. pp. 10 + tbls. P.R.

Revision of a progress report first issued in 1943. As a result of experiments in gluing compreg veneer into 3-ply panels it is concluded: (1) The glossy surface should be treated or removed by sanding; (2) The glue-spread should be light (7–12 grams of wet glue per sq. ft. of glue joint); (3) 60 minutes assembly period gave good results for intermediate-temperature-setting phenol resin glues at pressures of 25–450 lb./sq. in. and for urea-resin glues at pressures over 250 lb./sq. in. At pressures below 250 lb./sq. in., urea resins gave best joints with closed assembly period of 2–10 minutes; (4) minimum curing times were in general about twice as long as those normally required with the same glues in binding ordinary wood; (5) casein and animal glues formed relatively poor joints with compreg under the conditions of the test. *From authors' summary.*

33.17. Sawmilling

See also *For. Abstr.* 9 (No. 333).

[384]. 33.17. **[Special small sawmill number.]** *W. Cst. Lumberm.* 74 (1), 1947 (42–132).

This number of the *West Coast Lumberman* is devoted to the subject of small sawmills, which are of increasing importance in the western states of U.S.A. and British Columbia. Articles deal with the increase in numbers and distribution of small mills, methods of increasing output per man-hour, portable mills, specifications for small sawmills, etc.

[385]. 33.17. CRADDOCK-JONES, T. J. **The estate saw-mill lay out.** *Quart. J. For.* 41 (1), 1947 (3–7).

33.3. *Chemical Treatment*

[386]. 33.3 (485 : 47.1) : 01.6. **Technical literature on Swedish and Finnish paper and wood chemical industries.** Moon Memorial Library, New York State College of Forestry, Syracuse 10, N.Y. 1945. pp. 31.

[387]. 33.3 : 31.3. YORSTON, F. H. **Recent advances in the chemistry of wood.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (296–306).

This review deals with publications which appeared during the year ending October, 1946, but some work of earlier date is included. Attention is particularly directed to several thorough review papers dealing with special fields of cellulose and wood chemistry.

Use of Wastes

See also *For. Abstr.* 9 (Nos. 423–4).

[388]. 33.3 : 34.6. BENNETT, E. **The chemical investigation of lignin.** *Bull. Mass. agric. Exp. Sta.* No. 428, 1945 (25).

Pure lignin was added to finely ground samples of silage, timothy hay, corn stalks and oat hay, thoroughly mixed, inoculated with a soil suspension, and allowed to incubate at about 32° C. for several months. Lignin was in amounts equivalent to about 14 per cent. of the plant material, and nitrogen in the form of ammonium carbonate was added at the rate of 1 per cent. of total organic material. It did not appear that addition of lignin materially alters the rate of the aerobic decomposition of plant material if sufficient nitrogen is available.

[389]. 33.3 : 34.6. WALLERSTEIN, J. S., ALBA, R. T., and HALE, M. G. **Precipitation and recovery of malt and mold amylase by alkali-cook lignin.** *Arch. Biochem.* 8, 1945 (275–84). *Chem. Abstr.* 40, 1946 (1891). P.R.

[390]. 33.3 : 34.6 : 31.3 (43.1–5). HILL, A. C., and CAMPBELL, W. B. **Interview with Dr. K. Freudenberg, director of Institut für die Chemie des Holzes, Universität, Heidelberg.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 18, Item No. 22, [*n.d.*]. pp. 4. P.R.

Recent advances in lignin chemistry included:

(1) Laboratory work by I.G. Farbenindustrie on a lignin-polyethylene amine condensation product for base-exchange purification of water.

(2) The continuation of work on the hydrogenation of waste sulphite liquor and of Scholler and Bergius lignins. It was found in the hydrogenation of lignin that successful results depended to a certain extent on the type of metal used for the autoclave.

(3) A new development carried out by the Leverkusen plant of I.G. Farbenindustrie in which lime-free, concentrated, waste sulphite liquor is condensed with dioxydiphenyl sulphone or with diphénylolinethane to give tanning agents.

(4) A continuation of Dr. Freudenberg's own work on the origin of lignin development in the fibre. [Cf. *For. Abstr.* 8 (Nos. 1838 and 1839).]

[391]. 33.3 : 34.6. BROWNING, B. L., and CALKIN, J. B. **The fatty acids in tall oil: a literature review.** *Paper Tr. J.* 123 (26), 1946 (45–7). P.R.

[392]. 33.3 : 34.6. BURCH, G. N. B., SHAW, A. C., and NICHOLLS, R. V. V. **Canadian tall oils, their compositions and potential uses.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (127–32).

The chemical constants and analyses of six representative Canadian tall oils have been determined. The constants and analyses include moisture content, acid number, saponification number, iodine number, content of fatty acids, content of resin acids and content of neutral substances. These data have been compared with available information on American and Scandinavian tall oils. The spectrophotometric method of analysis has been applied to the fatty-acid fraction. A fair estimate of the amounts of stearic, oleic, linoleic and linolenic acids has been obtained. Fatty acids of the C_{16} series have been shown to be absent from Canadian tall oils. In the case of one oil, the percentages of conjugated linoleic and linolenic acids have been determined. The fatty acid fraction is to be classified as a semi-drying oil. The same tall oils have been analysed for their contents of phytosterols. They appear to be particularly rich in these useful materials. Potential production of Canadian tall oils and their products have been estimated and their uses have been appraised. An appeal is made for the encouragement of research on tall oil. *Authors' summary.*

[393]. 33.3 : 34.6 : 33.39. GADD, G. O. Hämmande faktorer vid förjäsning av sulfitavlut. [**Inhibiting factors in the fermentation of sulphite waste liquor.**] *Medd. Industr. CentLab., Helsingfors* No. 45, 1946. pp. 25. [Sw.sw.e.] *Repr.* from *Papp.-TravaruTidskr.Finl.* No. 7A, 1946.

The action of the most important inhibiting factors—directly titratable SO_2, acetaldehyde and furfural—was studied and the following conclusions were reached: (i) Directly titratable SO_2 in quantities as low as 0·01 per cent. will affect commercial yeast, whereas sulphite-alcohol yeast will stand up to 0·02–0·03 per cent. of SO_2 before the percentage of fermented sugar, as measured after 24 hours of fermentation, begins to decline. It appears, therefore, that the sulphite yeast has become largely acclimatized to SO_2 in the quantities normally occurring in neutralized sulphite waste liquor. (ii) Acetaldehyde in excess of 0·15 per cent. renders fermentation more difficult. (iii) The inhibiting effects of small quantities of directly titratable SO_2 are removed by acetaldehyde. If the consequent loss of aldehyde is made good, the yield of alcohol rises. (iv) Furfural, which regularly occurs in waste silk-pulp liquors, may have an inhibiting effect on fermentation. (v) Part of the furfural is reduced by the yeast. (vi) Directly titratable SO_2 is not completely bound by equivalent quantities of furfural. *From author's summaries.*

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

See also *For. Abstr.* 9 (No. 350).

[394]. 33.32. ARANOVSKY, S. I., RHODES, A., and LATHROP, E. C. **Agricultural residue pulps—comparison with typical wood pulps.** *Paper Tr. J.* 124 (13), 1947 (49–55). P.R.

The beating and strength characteristics of five agricultural residue soda pulps and some typical wood pulps were compared, using the same methods and equipment for both types of pulp. The former compared favourably with wood pulps in all of the strength characteristics except tear resistance. Except for the latter value, wheat-straw soda pulp had better strength properties and required much less beating than softwood sulphite pulps. The standard pulp testing equipment and methods are suitable, in the main, for agricultural residue pulps.

[395]. 33.32 : 12.25 : 31.8 : 31.1 (47.1). WEGELIUS, T. Det finska granvirkets egenskaper och kvalitetsvariationer. [**The properties and variations in quality of Finnish Spruce [as pulpwood].**] *Svensk PappTidn.* 49 (3), 1946 (51–61). [Sw.e.g.] P.O.

A lecture, based mainly on interim results of Finnish investigations, discussing the relations between suitability as pulpwood and factors such as dimension and taper of logs, density, ring breadth and late-wood percentage, fibre dimensions, and the presence of knots and compression wood. Preliminary results are reported from experiments on the influence of wood quality on the yield of groundwood and chemical pulp.

[396]. 33.32 : 12.25 : 45.3 : 13.2 : 31.23. **Beetle-killed Engelmann Spruce makes high quality paper pulp.** *Rep. Rocky Mt. For. Range Exp. Sta. 1946*, [1947?] (40).

More than 4 million bd.ft. of *Picea engelmanni* has been killed by bark beetles in the Rocky Mountain region since 1939. Owing to deep cracks which develop within a few years of killing, these trees become unsuitable for sawtimber. Tests by the Forest Products Laboratory indicate that the pulping qualities of the dead material are satisfactory. For some still unexplained reason, the specific gravity of the material is below average, and increasingly so towards the base of the trees.

[397]. 33.32 : 12.25. WILKIE, P. M. **Some practical aspects of Douglas Fir pulping.** *Pulp Paper Ind.* 20 (3), 1946 (64–7). P.A.T.R.A.

The advantages and disadvantages of using Douglas Fir for pulping are discussed. Pulp from Douglas Fir has a low bursting strength compared with pulps from other Western U.S. softwoods, but has an excellent tear resistance. Its cooking requirements are similar to those of Hemlock, but the charge of chemical per unit of digester volume must be equal to or slightly greater than that of Hemlock. Second-growth wood gives the most pulp—44 to 46 per cent. of screened fibre on the basis of dry wood. Foam troubles are likely but may be controlled by removing sources of agitation from the washing system. The low moisture content of the wood gives a more concentrated black

liquor. The adjustment of pulping variables to bring about minor improvements in the pulp should overcome most difficulties encountered. These adjustments will vary according to mill conditions, but, as a guide, some data collected at Camas Mill, Washington, are shown.

[398]. 33.32 : 12.26–8 (213 : 66.68). L'utilisation des bois tropicaux dans l'industrie des pâtes à papier. [**The utilisation of tropical woods in the pulp industry.**] *Rev. int. Prod. colon.* 22 (210), 1947 (56–9). [F.]

Besides a general discussion, information is given in a series of tables on length of fibre, diameter of fibre, ratio of length to diameter of fibre, tearing strength, bursting strength, yield of pulp, and quantities of bleach necessary in the manufacture of paper from the following Ivory coast species: Poë [*Strombosia pustulata*], Sougué [*Parinari tenuifolia*], Diabema [*Piptadenia africana*], Niangon [*Tarrietia utilis*], Bahia [*Mitragyna macrophylla*], Fromager [*Ceiba pentandra*], Oba [*Bombax flammeum*], Ouochi [*Albizzia zygia*], Emien [*Alstonia congensis*], Lo [*Parkia bicolor*], Vieda [*Coelocaryon oxycarpum*], Aiele [*Canarium schweinfurthii*], Iroko [*Chlorophora excelsa*], Parasolier [*Musanga smithii*], Essessang [*Ricinodendron africanum*], Samba [*Triplochiton scleroxylon*], Akede [*Antiaris welwitschii*], Fraké [*Terminalia superba*], Framiré [*Terminalia ivorensis*], Okoumé [*Aucoumea klaineana*].

[399]. 33.32 : 12.26–8 (44 : 66 : 67). Nobécourt, P. Le problème français des pâtes à papier. [**The French paper-pulp problem.**] *Rev. Bois Appl.* 2 (3), 1947 (21–6). [F.]

A discussion of paper-making pulps with special reference to French problems in this field. In spite of difficulties, French production of mechanical pulps is now 75 per cent. of the 1936–39 average monthly output, and that of chemical pulps 84 per cent., but this does not meet the country's needs. The Régie Industrielle de la Cellulose Coloniale, following up studies on tropical woods made at the Nogent Laboratory and the École Française de Papeterie recommends the following species for papermaking: *Musanga smithii*, *Aucoumea klaineana*, *Mitragyna macrophylla*, *Terminalia superba*, *Triplochiton scleroxylon* and *Ricinodendron africanum*. The author recommends the cultivation of plantations and the introduction of forest management to encourage the development of such species. It is planned to set up three or four chemical pulping mills in French Equatorial Africa. An experimental station at Bimbresso near Abidjan (Ivory Coast) is already nearing completion.

[400]. 33.32 : 12.26–8. Aribert, Ruthon, Nobécourt, and Doulat. Le bois d'Okoumé et son utilisation en papeterie. [**The wood of *Aucoumea klaineana* and its utilization in paper making.**] *Rev. int. Bois* 14 (115), 1947 (3–7). [F.]

Detailed report on experiments in the manufacture of pulp and paper from the wood of this species, which is much used for plywood veneer in the French Congo. It is desired to find a means of using the waste wood produced in veneer cutting. The unbleached pulp is suitable for the manufacture of wrapping papers and the bleached pulp for good-quality printing and writing papers.

[401]. 33.32 : 90 : 98. Glesinger, E. **Pulpwood for world prosperity.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (268–274).

The author urges the importance of the closest co-ordination of the lumber and pulpwood industries. In countries where the forests are closely utilized it will always be found that for a certain amount of lumber a corresponding quantity of pulp is being produced. Sweden is a good example of this; it achieves an excellent ratio, not only because Swedish industries use the whole tree and all the trees they cut, but because one-third of all the raw material that goes into Swedish pulp is sawmill waste. As a rule of thumb, a ratio of 1,000 bd.ft. of lumber to one ton of pulp is a fair average. Present world production is about 80,000 million bd.ft. of lumber to only 24 million tons of pulp. The discrepancy is almost as striking in the United States, with 30,000 million bd.ft. of lumber and only about 12 million tons of pulp. The results of a general co-ordination of lumber production and pulpwood operations would be a substantial increase in pulp production. The pulp industry has been a pioneer in the chemical conversion of wood unsuitable for lumber or pulp manufacture, but only a beginning has been made. The average annual cut in the world's forests is 1,200 million tons, but the total output of industrial wood products (excepting firewood)

is only 200 million tons a year, and the remaining 1,000 million tons are lost to industry and the consumer. A third factor in the extent of possible expansion is the fact that the world cut of wood comes from only a fraction of the world's forest land, and of the forest land used, only a fraction is intensively managed.

The importance is stressed of discovering the basic statistics of wood consumption and requirements and developing some system of measuring them comparable with that used for measuring nutritional requirements. An outline is given of the plans of F.A.O. for studying the consumption of wood in all its forms.

33.32.1. *Pulp Manufacture*

[402]. 33.32.1 : 09.4. DENNIS, D. A. (compiler). **Wood pulp statistics.** U.S. Pulp Producers' Association, New York, 1946. pp. xiii + 229. P.R.

[403]. 33.32.1 (43.1–5). MALCOLM, A. M. **Pulp and paper industry in the Leipzig area.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 76, Item No. 22, [1947?] pp. 19. P.R.

[404]. 33.32.1 (52) : 09.4. SEIDL, R. J. **Pulp and paper industry of Japan.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1640, 1947. pp. 13 + figs. P.R.

Wood-pulp mills in Japan proper (Hokkaido, Honshu, Kyushu, Shikoku) at the end of the war numbered about 90, and paper mills about 275. Most of the mills, with certain notable exceptions, are small and outmoded. Nearly one-half of the wood pulp produced in Japan during the 10-year period up to 1945 was concentrated in Karafuto. The loss of this area considerably reduces the raw material available, particularly chemical paper pulp of the sulphite and kraft types. Most of the rayon and mechanical pulp was produced in Japan proper; soda pulp in Japan and Formosa. Pulp production (all types) in the peak year of 1941 was 1,408,000 short tons. In 1945 it was only about 18 per cent. of this, owing to shortages of coal, chemicals and wood. The rayon pulp industry in Japan had expanded considerably before the war, but Japan also depended heavily upon imports for this type of pulp. In 1945 production of rayon pulp was only about 5 per cent. of the rated productive capacity of the remaining rayon pulp mills. The report includes figures for the production of pulps of all types in Japan. *From author's summary.*

[405]. 33.32.1 (71). ALLO, G. F. **A review of alkaline pulping procedures in Canadian mills.** *Paper Ind.* 27 (11), 1946 (1709–11). P.R.

[406]. 33.32.1. COLLINS, W. R., FREEMAN, R. D., ROBERTS, M. J., and HISEY, W. O. (to Dow Chemical Company, Midland, Mich.). **Purification of wood pulp.** *U.S. Patent* No. 2,385,259, May 10, 1943. *Paper Ind.* 28 (11), 1947 (1658). P.R.

A cold purification process for the production of at least 97 per cent. alpha-cellulose from wood pulp.

[407]. 33.32.1. DURGIN, A. G. **Uses of sulphate pulp.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (137–9, 150).

A review of the present uses of kraft pulp in the United States and Canada. These include paperboard production, wrappings and bags, gumming, waterproofing, towels, special industrial papers, fine papers, book paper, plastics.

[408]. 33.32.1. STOCKER, F. W., and DURANT, L. G. **A stain for the identification of bleached sulphite and bleached kraft.** *Paper Ind.* 27 (11), 1946 (1711–13). P.R.

[409]. 33.32.1 : 01.6. POTTER, G. J. C. **A review of the literature of the sulphite process Aug. 1945—Aug. 1946.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (249–50, 295–6).

[410]. 33.32.1. MURDOCK, H. R. **Sodium sulphite wood pulps.** *Paper Tr. J.* 124 (4), 1947 (51–2) P.R.

An outline of the uses of sodium sulphite as a pulping agent for the production of semi-chemical and purified pulps.

[411]. 33.32.1. GRANT, N. S., MASON, O. A., and DONNELLY, H. F. **A method of evaluating the unbeaten strength of unbleached chemical wood pulp.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (151–8).

A method is outlined for determining unbeaten strength of unbleached sulphite pulp, using the British disintegrator. Statistical methods are applied to test data, resulting in a 36-per-cent. saving of time, with an over-all increase in testing precision. The actual

precision of Canadian Standard freeness tests on unbleached sulphite is determined statistically and found to have an optimum value of ± 1·7 per cent. *Authors' summary.*

[412]. 33.32.1. BACKMAN, A. Karaktäriseringen av cellulosans malningstillstånd. **[Characterization of the state of beating of pulps.]** *Medd. Industr. CentLab., Helsingfors* No. 46, 1946. pp. 28. [Sw.e.] *Repr.* from *Papp.-TrävaruTidskr.Finl.* No. 7A, 1946.

A new criterion of the state of beating of pulps—the depression of the strength curves as measured by their 'angle coefficient'—is proposed and discussed.

[413]. 33.32.1. SIMMONDS, F. A., and KINGSBURY, R. M. **Bleaching of semichemical pulps.** *Paper Tr. J.* 124 (4), 1947 (53–60). P.R.

The results of experiments in bleaching semichemical pulps (chiefly neutral sulphite from various hardwoods) are reported. They illustrate chemical requirements, yields, properties of bleached pulps, and, to a limited extent, give a comparison of the single-stage hypochlorite, the single-stage sodium peroxide, and the multi-stage chlorine bleaching treatments.

Depending on the kind of wood, the lignin content of the pulp and the brightness required, the chlorine requirement for neutral sulphite semichemical pulps ranges from 10 to 30 per cent. based on pulp weight. Yields of bleached pulps, based on the wood, range from 55 to 85 per cent., depending on the degree of cooking and the method and degree of bleaching.

If only a low brightness, 75 or below, and a small strength increase are required, either the single-stage hypochlorite or the sodium peroxide processes appears to be satisfactory. Yields up to 98 per cent. of unbleached pulp are obtainable in the one-stage processes. When either a high brightness, a large strength increase, or both, are required, a multi-stage chlorine process should be used. With this process, yield of bleached pulp may be as low as 80 per cent. of the unbleached pulp. *Authors' summary.*

[414]. 33.32.1 : 12.25. STOBO, W. E., and RUSSELL, J. K. **The effect of certain variables in the bleaching of groundwood with sodium peroxide.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (224–32, 238).

The bleaching of groundwood with peroxides is entirely feasible as an industrial process, and under favourable conditions it should be possible to attain a brightness of 70 G.E. with a consumption of peroxide at a rate of 0·41 per cent. active oxygen or 2 per cent. sodium peroxide in terms of bone-dry pulp. A table is given showing the bleachability of different Eastern Canadian wood species. The highest average final brightness was obtained with Balsam Fir, the lowest with Jack Pine, and White and Black Spruce were intermediate. Other Pines also gave poor results, and it is improbable that satisfactory results will be obtained if the pulp contains appreciable quantities of the Pines found in Eastern Canada.

[415]. 33.32.1 : 34.6 : 91.1. WESTFALL, B. A. **Stream pollution hazards of wood pulp mill effluents.** *Fish Leafl. U.S. Fish Wildlife Serv.* No. 174, 1946. pp. 8.

The effects of pulpmill effluents on fish are described, they include direct toxic effects of the wood extractives, cumulative toxic effects, reduction of dissolved oxygen in the streamwater, specific toxic action of various accessory substances used in the manufacturing and processing of paper and other pulp products, and an unpleasant taste often found in the flesh of fish caught in a stagnant area below the paper mill.

33.32.3. *Wallboards, Fibreboards, etc.*

[416]. 33.32.3. BETTENDORF, H. J. **Paperboard and paperboard containers. A history.** Board Products Publishing Co., Chicago. pp. [iii] + 135. P.R.

[417]. 33.32.3 (47.1 : 48). BERGENDAHL, C. J. **Paperboard manufacturing in Scandinavia.** *Pulp Pap. Mag. Can.* 48 (3), 1947 (177–83).

An account of the capacity, processes and machinery used in the industry in Sweden, Norway and Finland.

[418]. 33.32.3 (485). LOWGREN, U. **Wallboard manufacture in Sweden according to the defibrator system.** *W. Cst. Lumberm.* 74 (2), 1947 (85–91).

A detailed account of the Asplund defibrator process for the manufacture of wallboard,

together with an outline of the development of the industry in Sweden [cf. *For. Abstr.* 7 No. 1306)].

[419]. 33.32.3 : 31.42. ENGLERTH, G. H. **Deterioration of fiberboard by molds.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 29, 1946. pp. 7 + tbls. + figs.

Mould tests made on various v- and w-fibreboards and experimental fibreboards indicated that urea-formaldehyde-starch and urea-formaldehyde-starch-asphalt-emulsion resins in solid v- and w-boards are not mould-resistant. Moulds penetrated through the surface of the solid fibreboard and caused delamination, and both v and w corrugated boards laminated with urea-formaldehyde-starch moulded heavily and were badly delaminated after 3 weeks. The addition of 1·7 and 2·0 per cent. sodium pentachlorophenate to the furnish reduced moulding and strength loss appreciably, with the higher concentration giving the better results. The results of the experiments are given in detail. *From author's summary.*

[420]. 33.32.3 : 33.15.2. **New plywood product announced.** *Timberman* 48 (6), 1947 (75, 78).

The West Coast Plywood Co., Aberdeen, Washington, have developed a new panel consisting of ordinary Douglas Fir plywood coated with a smooth, durable finish formed of woodflour mixed with resin and bonded to the plywood by polymerizing the material in the hot presses used in the manufacture of plywood. Only exterior-type plywood is used and the resin used as a binder in the surface is waterproof, so the finished panel of *Welchboard* is suitable for outdoor as well as indoor use. All the wood fibre for the surfacing is recovered from factory waste.

[421]. 33.32.3 : 34.6 : 33.1. **Wood waste into building boards. The Smith-Othmer partial hydrolisation process.** *Timber News* 55 (2092), 1947 (73). P.R.

The raw material, consisting of 100 per cent. of ligno-cellulose waste passed through a $\frac{1}{8}$-inch mesh screen, or of shavings, etc., not exceeding $\frac{1}{16}$ inch in thickness, with the addition of about 2 per cent. by weight of certain chemical plasticisers, is subjected to varying pressures from 450 to 750 lb./sq.in. (30 to 50 atmospheres) at a temperature between 240° and 260° C. This 'pressing' cycle lasts about 6 to 12 minutes for hard wallboards of about $\frac{3}{16}$ inch in thickness. The process can be used equally well for a 'dry' or 'wet' mixture, though, with the latter, more total heat is required in 'pressing'.

33.32.4. *Plastics*

[422]. 33.32.4. PENN, W. S. **Thermosetting mouldings from resin-impregnated pulp.** *Plastics, Lond.* 10 (112, 113), 1946 (456–63, 518–21). P.R.

[423]. 33.32.4 : 34.6 : 33.32. SEIDL, R. J., BURR, H. K., FERGUSON, C. N., and MACKIN, G. E. **Properties of laminated plastics made from lignin and lignin-phenolic resin-impregnated papers.** *Rep. U.S. For. Prod. Lab., Madison* No. 1595, 1944. pp. 7 + tbls. + figs. P.R.

[424]. 33.32.4 : 34.6 : 33.32.1. POWTER, N. B. **New form of lignin.** *Paper Ind.* 28 (12), 1947 (1744–6). P.R.

A new process is described whereby a form of lignin with a low melting point, which is easily moulded and worked, can be isolated from alkaline pulp waste liquor. CO_2 from the flue gas of the pulp mill is used as the primary acidifying agent. The liquor is sprayed in small droplets against a rising column of the gas. The resulting small particles of acid lignin salt are heated and melted to a viscous liquid which is readily separated from the aqueous black liquor by continuous decantation. The liquid is passed to a tank where it is dissolved in hot water and is then acidified with sulphuric acid to yield a water-soluble precipitate with a particle size of 2 to 15 microns. This is filtered on a continuous rotary filler and comes off as a thick amorphous paste, which, when passed through a suitable dryer, breaks down into a fine powder. This lignin powder, 'Tomlinite', has been successfully used in Canada in a phenolic-lignin enriched, paper-base laminate, marketed under the name of 'Arborite'. The production and properties of 'Arborite' are briefly described.

33.33. Manufacture of Textiles from Wood

See also *For. Abstr.* 9 (No. 350).

[425]. 33.33 : 34.6 : 33.1. BATE, S. C. (to British Celanese Ltd.). **Wood cellulose: isolation.** *Brit. Patent* No. 579,669, Aug. 12,

1946. *Brit. Cotton Ind. Res. Ass. Summ.* 26 (23), 1946 (492). D.S.I.R.

Cellulose is isolated from lignocellulosic material by heating the material (sawdust or chopped straw) at 90–100° C. with a mixture of a lower fatty acid and nitric acid (e.g. 10 parts of 70-per-cent. acetic acid containing 1 per cent. of nitric acid) through which air or oxygen is bubbled. The digestion is maintained for 4 or 5 hours and the residual cellulose is washed and bleached in the usual manner. Thus, Elm sawdust can be made to yield a pulp containing 94·5 per cent. of α-cellulose.

33.36. Preservation of Wood. Seasoning and Drying

33.36.1. *Preservation against Attack by Plants and Animals*

See also *For. Abstr.* 9 (Nos. 301–2, 319, 326, 354, 451).

[426]. 33.36.1. HNEÖR, F.-G. Procédé d'impregnation assurant la conservation des tissus cellulaires végétaux. [**Impregnating process for the preservation of vegetable cellular tissues.**] *French Pat.* in *Rev. Bois Appl.* 2 (3), 1947 (35). [F.] P.R.

The preservative solution is compounded of 1 g. of rotenone, 1 g. of carbon disulphide, 8 g. of chloroform, 50 g. of a siccative, 190 g. of paraffin oil, 250 g. of turpentine and 500 g. of linseed oil, which produce a colourless liquid of great viscosity. The rotenone provides protection against insects and fungi and the paraffin and linseed oil against moisture penetration. The preservative may be mixed with oil-soluble aniline dyes or mineral dyes.

[427]. 33.36.1 : 07.7. **Boric acid treatment of timber.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (4), 1946 (3–5).

A brief description is given of the construction, operation and probable cost of three types of tank for the boric acid treatment of timber. [Cf. *For. Abstr.* 9 (No. 354).]

[428]. 33.36.1 : 33.31 : 31.4. WECHEL, A. TE. Oriënteerend onderzoek naar de praktische waarde van enkele houtconserveeringsmiddelen. [**Preliminary investigation of the practical value of some wood preservatives.**] *Ned. Boschb.-Tijdschr.* 16 (8), 1943 (334–8). [Du.]

The results are given of a graveyard test, using for each treatment at least 150 sticks (1 × 1 × 20 cm. and planted 6–7 cm. deep) of *Populus nigra* wood, decay being judged after 1, 2 and 3 years by whether the sticks could be snapped at ground line without special force. After 3 years, total losses in percentage of initial number of sticks were 1–2 in the case of creosote (retention 0·85 kg. per kg. wood), Aczol (1 : 16; steeped for 7 days) and Xylamon (steeped for 24 hours); 12 in the case of $CuSO_4$ (5-per-cent. solution; steeped for 7 days) and 53 for a brush treatment with coal-tar. The remaining treatments, including four unnamed commercial products, wood tar, mercuric chloride and sodium fluoride with or without chromate, all gave losses of 96–100 per cent. by the third year.

[429]. 33.36.1 : 33.31. SWAAY, H. VAN. Onderzoek van houtconserveeringsmiddelen. [**The testing of wood preservatives.**] *Ned. Boschb.-Tijdschr.* 17 (3), 1944 (75–8). [Du.]

The author points out the inadequacy of tests such as those made by Te Wechel [see preceding abstract and *For. Abstr.* 9 (No. 315)] and the great difficulties involved in setting up and maintaining extensive scientific trials of this nature with larger sizes of timber. He stresses (*a*) the value of standard laboratory tests for comparative purposes, though admitting that they do not represent actual service conditions; (*b*) the large amount of information already available either in literature or in the business records of undertakings using or dealing in wood preservatives.

[430]. 33.36.1 : 33.53 (68). SOUTH AFRICA. **The preparation and preservative treatment of poles.** *Bull. Dep. For. S. Afr.* No. 30, 1945. pp. 40.

Instructions prepared in collaboration with the Forest Products Institute, to constitute the standard practice for Forestry Officers in the Union of South Africa. Part I contains instructions on the preparation and specification of poles, and Part II preservative treatments.

33.36.3. *Seasoning. Drying*

See also *For. Abstr.* 9 (No. 510).

[431]. 33.36.3 : 01.6. **List of publications on the seasoning of wood.** *Rep. U.S. For. Prod. Lab., Madison* No. R446, 1947. pp. 23. P.R.

[432]. 33.36.3 (943) : 31.22.1. **Equilibrium moisture survey—North Queensland.** *Aust. Timb. J.* 13 (1), 1947 (49, 61–3).

A survey was conducted by the Queensland Forest Service during the years 1937–39 to study the seasonal variation in mean moisture content of timber protected from rain but exposed to outdoor conditions in the principal sawmilling centres of Northern Queensland. The samples used were Satinay (*Syncarpia hillii*), Silky Oak (*Cardwellia sublimis*) and Hoop Pine (*Araucaria cunninghamii*). Maxima and minima for each species for each of the three years at 5 stations and of controls at Brisbane are given. These figures indicate that timber air-seasoned in Northern Queensland would require further drying before being entirely suitable for use in furniture, joinery or flooring in Brisbane or other places of similar or lower equilibrium moisture content. Tables are also given for average shrinkage of the tested species under those conditions.

[433]. 33.36.3. WRIGHT, G. W. **Recent developments in timber drying.** *For. Prod. News Lett. C.S.I.R. Aust.* No. 145, 1946 (3–4).

A short account is given of three improved methods of seasoning timber—solvent seasoning, vapour drying and high-frequency drying.

[434]. 33.36.3. TIEMANN, H. **Simplified principles in kiln drying lumber.** *Sth. Lumberm.* 173 (2173; 2175; 2177), 1946 (63–4; 59–60; 271–2).

[435]. 33.36.3 : 07.7. GOTTSCHALK, F. W., and ANGELL, H. W. (to Amer. Lumber and Treating Co.). **Kiln drying of lumber.** *U.S. Patent* No. 2,343,410, Mar. 7, 1944. Brit. Abstr. BI, 1946 (415). P.R.

The lumber is stacked as an elongated pile of roughly circular cross-section; stickers are thick where the pile is wide and thin where narrow. Air is circulated transversely through the enclosing shell being conveniently cylindrical with the widest space and fans at the top.

[436]. 33.36.3 : 07.7 : 31.22.2. RAUPACH, C. V. **Kiln operation improved by shrinkage analysis.** *Timberman* 48 (5), 1947 (132, 134, 136).

Description of the design and operation of a simple device to report drying progress of lumber in a kiln without the necessity for the operator to enter the kiln. In the main the apparatus consisted of a series of levers actuated by any change in the dimension of the load of lumber in the kiln, and recording it on a chart.

[437]. 33.36.3 : 33.4 (71). LECLAIR, W. J. Le séchage du bois de construction. [**The seasoning of constructional timber.**] *Timber of Canada* 7 (6; 7), 1947 (82–6; 80–3). [F.]

33.37. Distillation

[438]. 33.37. MARTÍNEZ HERMOSILLA, P. La industria de la destilación de leñas. El método Guinot en la recuperación directa del ácido acético. [**The wood distillation industry. The Guinot method in the direct recovery of acetic acid.**] *Montes, Madrid* 1 (2), 1945 (63–8). [Span.] I.M.I.

[439]. 33.37 (410) : 33.38.1. CHURCHOUSE, A. **Wood distillation in Britain.** *Timber News* 54 (2087), 1946 (322, 324). P.R.

A brief review of the history of charcoal production in Great Britain. It is estimated that during the war years 20,000 to 23,000 tons of charcoal were produced annually.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-gas Generators

[440]. 33.38 : 12.26–8 (92). SPOON, W. *Acacia decurrens*-houtskool van Nederlandsch-Indië. [***Acacia decurrens* charcoal from the Netherlands Indies.**] *Ned. Boschb.-Tijdschr.* 15 (8), 1942 (368–76). [Du.] (*Ber. HandMus. kolon. Inst. Amst.* No. 185.)

Mainly a review of literature, from which it it concluded that Wattle charcoal should have an assured future in Java as a domestic fuel, and would also be suitable for use in producer-gas generators. A test in Holland of its value in poultry food was entirely satisfactory, and though freight charges would prevent its competing in Holland with European Beech and Pine charcoals, its use for this purpose in the Netherlands East Indies would possibly open up a market for material too small for domestic or generator fuel.

[441]. 33.38.1 (43.1–5). LOCKE, E. G., and SAEMAN, J. F. **Wood carbonization industry of Germany.** *FIAT Final Rep.*

Joint Intell. Obj. Agency No. 444, 1945. pp. 62. P.R.

The report describes two activated-charcoal plants and the two latest wood-carbonizing plants to be constructed in Germany at Brilonwald and Bodenfelde, where the Riechert process was in use. One of the most important features in this process is the use of recycled wood gas for heating the 100-cu.m. retorts. A better control of temperature in the retort is obtained, and the products of the carbonization reaction are readily removed from the retort by a gas stream.

[442]. 33.38.1 (52) : 33.7. **Estimate of the charcoal and firewood situation in Japan (a preliminary report).** *Rep. Brit. Intell. Obj. Sub-comm.* No. BIOS/JAP/PR/680, 1946. pp. 11 + iv. [G.H.Q. Supreme Commander for the Allied Powers, Natural Resources Section.] P.R.

Normal production of charcoal in the 400,000 clay kilns existing in Japan before 1942 was 2,400,000 metric tons. In 1945 it has dropped to 1,282,000 metric tons. The drop is due to lack of workers, lack of the necessities of life for the existing workers, low ceiling prices and shortages of transport. Production of firewood keeps pace with consumer allotments and alleviates somewhat the scarcity of charcoal. Data on the production, stock piles and allotments of charcoal and firewood are given.

[443]. 33.38.1 : 07.7. HUGHES, J. F. **Charcoal made in forty-gallon drums.** *E. Afr. agric. J.* 12 (3), 1947 (195–6).

Notes on the construction and operation of two types of kiln, each made from a 40-gallon oil-drum.

[444]. 33.38.1 : 07.7. OLSON, A. R., and HICOCK, H. W. **A charcoal kiln made of cinder-concrete blocks.** *Bull. Conn. agric. Exp. Sta.* No. 494, 1946. pp. 30. P.R.

The construction and operation of two charcoal kilns built of cinder-concrete blocks are described. The yield of charcoal is higher than from steel kilns and the operation is easier. Wood of any moisture content can be coaled successfully, but the yield from wood with a moisture content of more than about 80 per cent. is low. The cinder-concrete kiln is not portable, but is easily dismantled and rebuilt.

[445]. 33.38.2. WYSS, E. Einbau und Betrieb der Holzkohle-Generatoranlage auf einem Sportflugzeug AC4. [**Installation and running of a charcoal gas generator on an AC4. sports aircraft.**] *Aéro-Revue* 19 (11), 1944 (453–5, 460). [G.] L.S.

33.39. Manufacture of Sugar, Oils, Alcohol, and Miscellaneous Chemical Products from Wood

See also *For. Abstr.* 9 (No. 393).

[446]. 33.39 : 07.7. LES USINES DE MELLE. **Wood saccharification plant.** *Brit. Patent* No. 579,116, July 24, 1946. [Brit. Cotton Ind. Res. Ass. Summ. 26 (22), 1946 (478).] D.S.I.R.

The claim is for a method of manufacturing sugar from wood and other cellulosic material by acid hydrolysis in which destruction of sugar through continued action of the acid is reduced by arranging for a series of hydrolyses at increasing temperatures, interspersed with a series of diffusions to remove the sugar formed from the residue. A set of acid tanks, cooking vessels, and counter-current diffusion batteries is shown in a diagram. The first digestion is with hydrochloric acid, 5 grams per litre, at 90° C., the second with acid of 4 g. per l. at 175° C., the third 3 g. per l. at 185° C., and the fourth 2·5 g. per l. at 195° C., and preferably the diffusion liquor for one battery is the acid for the succeeding cooking step. The cooking vessels may be reduced in size step by step and the cooking periods are also reduced stepwise. The liquor removed in the first diffusion battery contains much pentose and is collected separately for use as a source of furfuraldehyde. The final residue is a source of lignin.

[447]. 33.39 : 12.25 : 12.26–8 (94). LYNCH, C. **Australia experiments with sugar products from wood.** *Timber of Canada* 7 (8), 1947 (62).

Samples of selected Australian timbers have been tested at the U.S. Forest Products Laboratory at Madison for sugar production. Australian-grown *Pinus radiata* has a sugar-reducing potential of 70 per cent. and a fermentability by yeast sorption of 81·6 per cent. Figures for *Eucalyptus regnans* are 68 per cent. and 73.3 per cent., for *E. obliqua* 69.2 and 73.5, and for *E. marginata* 49.9 and 79 per

cent. respectively. *P. radiata* was similar in behaviour during hydrolysis to American White Spruce. *E. regnans* was similar to American hardwoods, with the exception that it contained a large amount of resinous material which was freed during hydrolysis and passed out into the pipes carrying the sugar solution. When this resinous material cooled, it set to a hard mass which required melting with a blow lamp for removal. *E. obliqua* appeared to contain less resinous material, but needed large quantities of yeast and longer periods of acclimatization to promote satisfactory fermentations. *E. marginata* has some properties similar to those of American Redwood, in that considerable quantities of dark red colouring were removed with the sugar. The total carbohydrate content of this wood is low, resulting in low yields of reducing sugar and alcohol.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

See also *For. Abstr.* 9 (Nos. 430, 626).

[448]. 33.51 (410). **The case for home-grown pit props.** *J. Land Agents' Soc.* 46 (5), 1947 (117–21).

The writer analyses the costs of producing pitprops in Britain for the home market in the light of the revised prices. He concludes that the use of thinnings for unpeeled props is an economic proposition, but that the extra charge for peeled props is not sufficient to cover the cost of peeling. A problem which still awaits solution is the utilization of very rapidly grown thinnings, which have not the requisite degree of strength. It is suggested that this difficulty might be met by increasing the ratio of diameter to length of pitprops.

[449]. 33.51 (492) : 31.0. OUDEMANS, T. C. 'Sprekend' hout in den mijnbouw. [**'Talking' wood in the mines.**] *Ned. Boschb.-Tijdschr.* 17 (6), 1944 (177–9). [Du.]

In answer to an enquiry from the author, the Inspector-General of the mines at Heerlen stated that conifer timber, chiefly Scots Pine but also some Larch and Norway Spruce, was being most used for mine timbers. These species all gave audible warning of failure. Weymouth Pine and 'witte den' (*Picea glauca*?) were quite unsuitable and did not give warning. Hardwoods were also being used to some extent, owing to war-time difficulties in supply, but were of very variable quality as regards strength properties and ability to give warning, owing not only to site conditions and silvicultural treatment, but also to inadequate drying. Neither Corsican nor Austrian Pine was mentioned in this statement.

[450]. 33.52 : 12.26–8 (88 : 492). SPOON, W. Dwarsliggers uit Suriname. [**Sleepers from Surinam.**] *Ned. Boschb.-Tijdschr.* 18 (2), 1946 (33–5). [Du.] (*Med. HandMus. kolon Inst. Amst.* No. 209.)

Surinam is suggested as a possible source of sleepers for Holland. The species most likely to be suitable are *Mora excelsa* and *Ocotea rubra*. An account is given of the very limited experience with these as sleeper timbers in the past.

[451]. 33.52 : 12.26–8 : 33.36.1 (91.1 : 492). SPOON, W. Indische dwarsliggers in Nederland. [**Sleepers from the East Indies in Holland.**] *Ned. Boschb.-Tijdschr.* 15 (3), 1942 (89–97). [Du.] (*Bericht van de Afdeeling Handelsmuseum van het Koloniaal Instituut* No. 177.)

In 1938, sample sleepers of Kroewing (*Dipterocarpus* spp.) and Kapoer (*Dryobalanops* spp.) were made in Borneo and sent to the railway authorities in Holland for testing, the results of which showed that the compressive strength and screw-holding capacity of Kroewing were somewhat below those of European Oak, and those of Kapoer were slightly higher than those of Baltic Redwood. The prices offered for further sample consignments were slightly lower than those for European Oak in the case of Kroewing, and the same as for Baltic Redwood in that of Kapoer. The latter was regarded as uneconomic, but 812 Kroewing sleepers were exported from Samarinda, E. Borneo, to Holland in 1939. They were first impregnated in Holland by the Rüping process under the same schedule as that for Baltic Redwood, but as this was found to give a retention of only 40 litres of creosote-oil per cu.m., they were then re-impregnated under the schedule for Oak, which doubled the retention of preservative but did not give absolutely complete penetration. In May-June, 1940, they were laid in track and in 1942 had shown some checking.

[452]. 33.53 : 12.25. BENNETT, W. **Poles from the forests of the Pacific Northwest.** *For. Cl. Quart.* 20 (2), 1946–47 (3–8).

An account of the U.S. pole industry, the increasing use of Douglas Fir for this purpose, standard specifications and dimensions for creosoted Douglas Fir poles, methods of harvesting, preparing and treating the poles.

33.6. *Packing Boxes, Crates, etc.*

[453]. 33.6 : 01.6. **List of publications on box and crate construction and packaging data.** *Rep. U.S. For. Prod. Lab., Madison* No. R791, 1947. pp. 17. P.R.

33.7. *Firewood*

See also *For. Abstr.* 9 (Nos. 350, 442).

[454]. 33.7 : 31.22.1. GHELMEZIU, N. Contribuțiuni la intocmirea unei norme pentru măsurarea umidității lemnului de foc. [**Contributions to the establishment of a norm for measuring the moisture content of firewood.**] *Repr.* from *Anal. Inst. Cerc. for. Român* (*Ser. I*) 10, 1944–45 (45–74). [Rum.f.] P.R.

Defines the dimensions and position of a test piece which will give a value nearest to that of the whole portion sampled.

[455]. 33.7 : 34.6 : 33.1. **Dry waste for Pres-to-logs.** *Timberman* 48 (4), 1947 (48).

The Capital Lumber Co. of Salem, Oregon, has developed a means of drying green shavings and chips from their planers for use in making Pres-to-logs, thus eliminating the necessity for long drying of fuel chips before they can be compressed into logs. By use of a hot blast furnace and a system of hot-and-cold cyclones, the moisture content of the shavings and chips is reduced to 6–10 per cent., and the dried material is then fed direct into the Pres-to-log machines.

33.8. *Other Manufactured Products*

See also *For. Abstr.* 9 (Nos. 298–9, 331, 369, 371, 467).

[456]. 33.8 : 12.25. NICHOLS, C. R. **The manufacture of wood-cased pencils.** *Mech. Engng.* 68 (11), 1946 (956–60). D.S.I.R.

A fairly detailed description of the whole process of manufacture of wood-cased lead pencils, including the preparation of the wood slats, which are kiln-dried, dyed in pressure vats, and then impregnated with wax. *Juniperus virginiana* was formerly used almost exclusively for this purpose, but now that supplies of this species are almost exhausted, its place is being taken by *Libocedrus decurrens.*

33.9. *Grading and Storage of Converted Timber*

See also *For. Abstr.* 9 (No. 350).

[457]. 33.91 (410) : 01.2. **Nomenclature of commercial timbers including botanical names and sources of supply. B.S. 881: Hardwoods. B.S. 589: Softwoods.** *Brit. Stand.* No. 881 and 589, 1946. pp. 101.

[458]. 33.91 (94) : 33.4. **Australian schedule of dimensions of structural timbers for use in domestic building construction.** *Tech. Stand. Aust.* No. 0.56–1946, May, 1946. pp. 15. Standards Association of Australia, Science House, Gloucester and Essex Streets, Sydney. D.S.I.R.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

See also *For. Abstr.* 9 (No. 200).

34.21. Fodder Grass and Grazing

See also *For. Abstr.* 9 (Nos. 494, 523–4).

[459]. 34.21 (46). BURGERS, P. H. Aanvulling van een boschbedrijf in Andalusië. [[**Animal husbandry as**] **a complementary industry on a forest estate in Andalusia.**] *Ned. Boschb.-Tijdschr.* 16 (2), 1943 (82–4). [Du.]

Cf. *For. Abstr.* 9 (Nos. 193–7).

[460]. 34.21 (485) : 07.7. LILLIEHÖÖK, B., and BJÖRKHEM, K. E. Traktorröjning av kulturbeten inom Jämtlands län. [**Clearing by tractor for the establishment of cultivated pastures in Jämtland.**] *Svenska SkogsvFören. Tidskr.* 45 (1), 1947 (23–32). [Sw.]

A descriptive, illustrated account of work on varied types of ground in Jämtland, using an Allis-Chalmers HD-7W tractor with a special Swedish-made stump-clearing and brush-bunching attachment which consists of a heavy horizontal bar with stout, forward-inclined teeth below and a vertical plate above, the whole mounted as a bulldozer blade. This device proved excellent for stump- and stone-grubbing (e.g. stones of about 6 tons were removed in 10–15 minutes), and also cleared brushwood and most of the ground cover, working best with the teeth reaching about 15 cm. below the soil surface. The material cleared was deposited in windrows for subsequent burning, the best spacing for the latter being about 40–50 m. apart. Good work was done on both mineral soils and peats; the latter, if over 40 cm. thick, must first be drained, and all peats are better drained before clearing. The machine works on slopes up to 20° almost as well as on level ground, but at 30° backing becomes impossible. Notes are included on approximate costs of clearing various types of ground. In general, costs are about half those of manual work. Almost all the treated sites could be ploughed afterwards, which in the case of artificial pastures renders possible the creation of higher-quality sward and the use of smaller areas than would otherwise be necessary.

[461]. 34.21 : 11.62 : 12.19.23 : 12.26–8. **Net rainfall and soil moisture under Aspen not affected by cattle grazing.** *Rep. Rocky Mt. For. Range Exp. Sta. 1946*, [1947?] (33–4).

Cattle grazing is shown to have no significant effect on rainfall reaching the soil surface or on autumn soil moisture, but to cause marked differences in composition and density of herbaceous vegetation.

[462]. 34.21 : 43 : 23.1 (54.5). DAS, P. ***Panvin* burning in some of the upper Simla hill states.** *Indian For.* 73 (3), 1947 (121–2).

The author strongly condemns the annual burning of pastures and *dehat* (village) forests practised in some of the upper Simla hill states. The burnt *dehat* forests are covered with bracken which in winter forms a thick layer of slow-decaying vegetation, making regeneration of tree species difficult. Saplings which do appear are usually burnt back.

34.23. Wood Ash. Potash

[463]. 34.23 : 12.26–8 (54). INDIA AND BURMA. **[Potash from wood ash.]** *For. Res. India Burma* Pt. 1, [1946?] (73).

An investigation is in progress on the potassium content of wood or plant ash. The results of analysis of 36 species are given. Among woody species *Holarrhena antidysenterica, Trewia nudiflora, Diospyros embryopteris, Prosopis spicigera, Mangifera indica* and *Butea frondosa* have given the highest results.

34.24. Tanning Materials. Cork

[464]. 34.24 (81). HORN, E. F. **Brazilian tanning materials.** *Trop. Woods* No. 88, 1946 (32–4).

[465]. 34.24 : 12.26–8 (64). MÉTRO, A. Note sur le liège au Maroc. **[Note on Morocco cork.]** *Rev. Eaux For.* 85 (3; 4), 1947 (137–49; 223–39). [F.]

Notes on the methods of harvesting, marketing, and preparing cork, with figures for the Moroccan trade.

[466]. 34.24 : 12.26–8 (79.4) : 47. METCALF, W. **The Cork Oak tree in California.** *Econ. Bot.* 1 (1), 1947 (26–46).

Cf. *For. Abstr.* 7 (No. 1355).

[467]. 34.24 (944) : 33.8. **Timber corks.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (11), 1946 (6).

Satisfactory substitute corks were made from wood of *Podocarpus elatus, Araucaria cunninghamii* and *Panax elegans* by a process which involved cooking under pressure in a solution of sodium hydroxide. The corks produced were resilient and had no tendency to spring out of the bottles. *A. cunninghamii* is most suitable for corking liquids.

34.25. Christmas Trees. Medicinal and Edible Plants

See also *For. Abstr.* 9 (Nos. 478, 492).

[468]. 34.25 : 12.25 (73) : 23.2. COPE, J. A. **Christmas-tree farming.** *Ext. Bull. Cornell Univ.* No. 704, 1946. pp. 32.

Practical advice on the planting, harvesting and marketing of Christmas trees.

[469]. 34.25 : 12.25 : 12.11.3. NEW YORK. **[Investigation of Scotch Pine Christmas trees.]** *Rep. N.Y. St. Conserv. Dep.* 1946. pp. 99–100.

The slower-growing types of Scots Pine, which form a compact crown, are the most desirable for Christmas trees. Trees of Black Forest provenance are especially to be preferred on account of their form and because their foliage retains its blue-green colour in winter, while the needles of the Riga and Scandinavian varieties tend to become yellowish after about November 1st in New York State.

[470]. 34.25 (75.1). **Christmas greens industry survey.** *Rep. Del. St. For. Dep.* 1945. pp. 15–7.

The Delaware Forest Department has made several surveys of the important trade in Holly, Mistletoe, etc., the total estimated value of which was $191,000 for the year 1944, an increase of 15 per cent. on that for 1936, though the volume of greenery involved was 61 per cent. less. This is due mainly to the cutting of smaller sprays, less weight per package, and consequently less damage to the trees. The native Hollies are meeting increased competition from cultivated English Holly (*Ilex aquifolium*), which cannot be grown commercially in this state. Mistletoe (*Phorodendron flavescens*), formerly a valuable item in the industry, has been much reduced by gales, sleet storms, heavy snow, and closer harvesting of Gum trees (*Liquidambar styraciflua* and *Nyssa sylvatica*), its most common hosts.

[471]. 34.25 (79.4 : 79.5). STUHR, E. T. **The distribution, abundance and uses of wild drug plants in Oregon and southern California.** *Econ. Bot.* 1 (1), 1947 (57–68).

[472]. 34.25 : 12.26–8 (47.2) : 12.11.11. KRASIL'NIKOV, P. K. O soderzhanii askorbinovoy kislotȳ (vitamina C) v listyakh nekotorȳkh derev'ev i kustarnikov. **[The ascorbic acid (vitamin C) content of leaves of some trees and shrubs.]** In *Sbornik Nauchnȳkh Rabot . . . (1941–1943).* Botanicheski Institut im. V. L. Komarova, Leningrad, 1946. pp. 323–30. [Russ.]

Results of determinations of ascorbic acid in leaves of 47 woody species growing in Leningrad Province are discussed and tabulated. Many were richer in the vitamin than most fruits, vegetables and herbaceous species.

(1) Different leaves from the same individual differed in ascorbic-acid content; the maximum was noted in leaves from the southern side of the crown and the minimum in those from the northern side. This difference was much greater on bright and warm than on dull days.

(2) The ascorbic-acid content was at its maximum during the daytime and fell considerably in the morning and evening. Leaves from the southern side showed this variation most clearly.

(3) Leaves from normal and coppice shoots of *Tilia platyphyllos* contained about twice as much ascorbic acid as those from short shoots.

(4) Data on seasonal variations disagreed with V. N. Bukin's conclusions, but fully confirmed those of H. G. Moldtmann. In general, ascorbic-acid accumulation is rapid in spring, attains a maximum in the summer (June-Sept.), though varying much with weather (e.g. falling on dull and cold days), and shows a sharp decrease in the autumn when the leaves turn colour.

(5) Leaves from different individuals of the same species collected from the same parts of the crown and at the same time, varied considerably in their ascorbic-acid content.

(6) Ascorbic acid in leaves decreased rapidly after picking, e.g. leaves of *Tilia platyphyllos* lost in five days more than ¾ of their initial ascorbic acid. Drying the leaves also caused a great decrease in their ascorbic-acid content.

[473]. 34.25 : 12.26–8 (96). PÉTARD, P. Essais de culture d'Arbres à Quinquina á Tahiti. **[Experiments in growing Cinchona in Tahiti.]** *Rev. int. Bot. appl. Agric. trop.* 26 (289–90), 1946 (654–6). [F.] P.R.

Cinchona ledgeriana and *C. succirubra* were introduced into Tahiti in 1938 and appear to be perfectly acclimatized. Their growth is normal, they have been attacked by no disease or insect pests, and produce commercially exploitable bark.

[474]. 34.25 : 12.26–8 : 12.11.11. STIMSON, M. M., and REUTER, M. A. **The spectrophotometric estimation of methoxy-cinchona alkaloids.** *J. Amer. chem. Soc.* 68 (7), 1946 (1192–6). D.S.I.R.

The spectra of a number of cinchona alkaloids have been reported together with a method for spectrophotometrically estimating the amount

of the methoxy-alkaloids in crude materials with special reference to quinine-quinidine in totaquine.

34.26. Resin. Turpentine. Oils. Gums. Rubber. Latex. Dyestuffs

See also *For. Abstr.* 9 (Nos. 193, 253).

[475]. 34.26 (73). OSTROM, C. E. **History of gum naval stores industry.** *Chemurg. Dig.* 4 (13), 1945 (217, 219–23). M.O.S.

[476]. 34.26 : 12.25 : 12.11.11. LOMBARD, R. Contribution à l'étude des acides résiniques: étude de la composition des gemmes de pin et de la résine d'épicéa. Obtention d'un nouvel acide primaire, l'acide dextrosapinique. **[Contribution to the study of resin acids: study of the composition of Pine and Spruce resin. Isolation of a new primary acid, dextrosapinic acid.]** (5e *Ser.*) *Bull. Soc. chim. France* 12 (4–6), 1945 (395–405). [F.] L.S.

[477]. 34.26 : 12.25 (54). INDIA AND BURMA. **[Turpentine from *Pinus longifolia* and the manufacture of synthetic camphor in India.]** *For. Res. India Burma* Pt. 1, [1946?] (69).

The only readily available raw material for manufacturing synthetic camphor in India is turpentine from *Pinus longifolia*, of which the α- and β-pinene content varies between 30 and 42 per cent. Experiments were conducted to determine the most economic way of concentrating α- and β-pinene in one fraction. Only 40 per cent. of the bulk turpentine oil is usable for the synthesis of camphor. The cost of isolating the fractions which make up this 40 per cent. may not be prohibitive.

[478]. 34.26 : 12.26–8 : 34.25. SHANKAR, K., and SHANKAR, U. **Chemical investigations on Kakra Singi, *Pistacia integerrima*. Part I—The essential oil.** *J. sci. industr. Res. India* 5 (5), 1946 (60–5). [Council of Scientific and Industrial Research, Delhi.] I.H.

The essential oil obtained by steam-distillation of the indigenous drug Kakra Singi contains: α-pinene (25 per cent.), camphene (27 per cent.), dl-limonene (4–5 per cent.), 1 : 8-cineol (10 per cent.), α-terpineol (20 per cent.), and aromadendrene (4–5 per cent.); also a small percentage of a lactonic stearoptene. Caprylic acid occurs free in the oil to the extent of about 15 per cent. by volume. *From authors' summary.*

[479]. 34.26 : 12.26–8. **An interesting essential oil from *Backhousia anisata*.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 1 (9), 1946 (4–5).

The leaves of Ringwood yielded 0·5 to 0·6 per cent. fresh weight of oil which was almost identical with the requirements of the British Pharmacopoeia for oil of aniseed. Enough Ringwood occurs in the Bellinger River Valley to maintain a distillation plant. Coppice growth is very vigorous.

[480]. 34.26 : 09.4. HANSEN, P. L. **World trends in major oil crops.** U.S. Bureau of Agricultural Economics, Washington, D.C., 1946. pp. 62.

The data used in this report were obtained principally from statistics originally published by the International Institute of Agriculture at Rome. Among the crops considered are Coconut, Palm, Olive, Babassu, and Tung oils.

[481]. 34.26 (47.0). STANKOV, S. S. Dikorastushchie maslichnye rasteniya S.S.S.R. i ikh prakticheskoe ispol'zovanie. **[Wild oil-yielding plants of the U.S.S.R. and their practical utilization.]** Sel'khozgiz, Moscow, 1944. pp. 76. *Abstr. in Sovetsk. Bot.* 14 (4), 1946 (290–1). [Russ.] O.B.D.

An illustrated brochure. Part I deals with the general characteristics of fatty oils and the plants from which they are derived, with special notes on plants yielding oils suitable for particular purposes (foods, paint, soap, etc.). Part 2 discusses plants containing drying oils of iodine number exceeding 130, including among the most interesting the trees *Pinus sibirica*, *P. koraiensis*, *P. pumila*, other Pines, *Larix*, *Picea* and *Juglans regia*. Part 3 describes species yielding semi-drying oils of iodine number varying from 85 to 130, and including *Tilia parvifolia* and other Limes, *Fagus* and some species of *Abies*. Part 4 deals with species containing non-drying oils with an iodine number of about 85, e.g. *Corylus avellana*, *Euonymus* spp.; and Part 5 with some whose seeds contain fatty oils and which are considered worthy of further investigation, e.g. *Caragana arborescens*, *Robinia pseudoacacia* and Birch. Many of the data are said to be published for the first time.

[482]. 34.26 (47.0). SHARAPOV, N. I. O polnotsennŷkh zamenitelyakh masla tunga. [**Substitutes for Tung oil.**] *Sovetsk. Bot.* 14 (5), 1946 (335–8). [Russ.] O.B.D.

Some preliminary data are given on possible substitutes for Tung oil from the Russian herbaceous plants *Salvia sclaria*, *Elsholtzia patrini*, *Euphorbia palustris* and *E. virgata*, and a tabular comparison is made of the iodine number, refractive index and specific gravity of oils from the last three with those of Tung and linseed oils. It is urged that further detailed investigation should be made, in the first place of the *Euphorbia* spp. and possibly other Euphorbiaceae, to which family the Tung tree belongs.

[483]. 34.26 (47.9). DZHIDZHAVADZE, S. Sh. Novŷe dannŷe o maslichnŷkh rasteniyakh Sovetskikh vlazhnŷkh subtropikov. [**New data on oil-yielding plants of the Soviet moist subtropics.**] *Sovetsk. Bot.* No. 5/6, 1941 (43–8). [Russ.] [Batum Subtropical Botanic Garden.] O.B.D.

An account of preliminary tests, undertaken with a view to discovering possible substitute oils (in the first place for Tung oil) for use in the paint and varnish industry, on seed oils from species grown in Batum Subtropical Botanic Garden. (i) *Mallotus japonicus* yielded an oil much resembling Tung in properties. It was of high viscosity, with a refractive index of 1.5130 and very quick-drying. The species is a good cropper and the oil content of seed kernels was about 38 per cent. (ii) *Manihot carthaginensis* (not fully acclimatized, but though cut back by winter frosts, forms new shoots bearing abundant seed) gave a slow-drying oil of the semi-drying type, with a refractive index of 1·4783 and iodine number (increasing with maturity of fruit) up to 133·9. The oil content of the kernels was 54–55 per cent. (iii) *Sapium sebiferum* (well acclimatized and a prolific seeder) gave a quick-drying oil of iodine number (ripe seed) up to 186·6. Both iodine number and refractive index [not quoted] were lower in oil from unripe seed, and it appears that as these values increase in the seed oil they show a corresponding decrease in the waxy substance ('Chinese tallow') covering the seeds. (iv) *Buxus sempervirens* seeds contained up to 45 per cent. (increasing with maturity of seed) of an oil of refractive index 1·4788 and iodine number (ripe seed) 123, and quicker-drying than linseed oil. The species is native and a prolific seeder: it is provisionally estimated that as much as 1 metric ton of oil might be obtained per ha. (v) *Salvia splendens* seed contained up to 32 per cent. of quick-drying oil of iodine number 160·3, refractive index 1·4810 and saponification number 184. (vi) *Daphne pontica* kernels (not fully ripe) contained about 59 per cent. of an oil of refractive index 1·4772, iodine number 106·17, drying rather slowly and classified as 'drying' by the film test but 'semi-drying' by its iodine number. (vii) *Euscaphis staphyléoides* yielded a drying oil of refractive index 1·4809. (viii) *Hamamelis virginiana* seed contained 52·1 per cent. of an oil of refractive index 1·4772, drying but forming a rather soft film, and of possible interest to the food industry. (ix) *Eryngium maritimum* seed had an oil content of 43·5 per cent. The oil was slow-(semi)-drying with a refractive index at 20° C. of 1·4750 and an iodine number of 103·18, probably of most interest to the soap industry.

The species that so far appear of possible interest for the paint and varnish industry are (i)–(vi) and especially (i), (iv) and (v), but much further investigation is required.

[484]. 34.26 : 12.26–8 (54). **Cashew nut tree.** *J. sci. industr. Res. India* 5 (6), 1946 (265–9). I.H.

Anacardium occidentale, introduced into India from Brazil some 400 years ago, has become naturalized in the west coastal region which produces more than 70 per cent. of the total Indian crop. Cultivation has been greatly extended in those areas during the last two decades, owing to the heavy demand for kernels in American and other foreign markets. Up to 1925, kernel exports did not exceed 50 tons, but in 1941 they reached a total of nearly 20,000 tons.

The composition of the kernels, which form a highly nutritious and concentrated food, is very similar to that of sweet almonds. The commercially important oil (representing 40·5 per cent. of the kernel) consists mostly of the glycerides of oleic (73·8 per cent.), linoleic (7·7 per cent.), stearic and palmitic acids. The properties of the oil are as follows: sp.gr. at 15° C., 0·9155–0·9180; $n^{40°}$, 1·4623–1·4633; acid val., 2·2–8·2; sap.val., 180·0–190·6; iod. val., 80·8–89·0; unsapon. matter, 0·41 per cent.

[485]. 34.26 : 12.26–8* : 34.27. CHOPIN, L. Caractéristiques de l'huile de marrons d'Inde.

[**Characteristics of Horse Chestnut oil.**] *Chim. anal.* 28 (1), 1946 (13). [F.]

The properties and characteristics of the oil of Horse Chestnuts are set out. Oil content is low, but the oil itself is characterized by a very low freezing point.

[486]. 34.26 : 12.26–8 : 34.27 : 12.11.11. VARIER, N. S. **Fixed oil from the seeds of *Artocarpus hirsuta*, Lamk.** *J. Ind. chem. Soc.* 22 (9), 1945 (275–7). L.S.

[487]. 34.26 : 12.26–8 : 34.27. FRANÇOIS, T. L'Ongokea et son huile. [**Ongokea and its oil.**] *Rev. int. Bot. appl. Agric. trop.* 26 (287/8), 1946 (561–7). [F.] P.R.

Isano oil is obtained from the seeds of *Ongokea klaineana* in West Africa. Unlike Tung oils, which can be subjected to temperatures of 260°—280° C. to harden them, Isano oil will not stand great heat. Mixed with other oils, however, such as linseed oil, oil of olive husks, grape seed oil and peanut oil, it has an improved resistance to water and forms a harder film. The problems of heating can also be solved by mixing the oil in this way.

[488]. 34.26 : 12.26–8. INDIA AND BURMA. [**Oleoresin from *Ailanthus malabarica.***] *For. Res. India Burma* Pt. 1, [1946?] (71).

The alcohol-soluble fraction (95 per cent. of the whole) has: acid value 29·2, saponification value 64·2, ester value 35·0, ash 0·2. The resin falls into the Elemi class and could be used as a satisfactory substitute in varnishes and lacquers.

[489]. 34.26 : 12.26–8 (66.2 : 66.9 : 67.2). VENAULT, G. La gomme arabique dans la région du Tchad. [**Gum arabic in the Chad region.**] *Agron. trop.* 1 (3/4), 1946 (179–81). [F.]

Considerable stands of *Acacia senegal* exist in the neighbourhood of Lake Chad in the French Niger and Chad colonies and British Nigeria. In Nigeria the natives regularly tap the trees for gum; in the French colonies the gum is obtained from natural exudations, which are not plentiful except in areas with an average annual rainfall of less than 500 mm. Notes are given on attempts at artificial regeneration of *A. senegal*, and on the conditions of the trade in gum. The principal obstacle to the trade in this region is the lack of proper communications.

[490]. 34.26 : 12.26–8 (47.8). KOMLEV, P. P., and SOKOLOV, S. YA. Borodavchatŷ beresklet v lesakh Tatarskoy A.S.S.R. i ego ispol'zovanie. [***Euonymus verrucosus* in the forests of Tartar A.S.S.R. and its utilization.**] *Sovetsk. Bot.* 14 (5), 1946 (329–33). [Russ.] [V.L. Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad.] O.B.D.

Euonymus verrucosus, the root bark of which is a source of gutta, is a shade-bearing shrub, up to 3 m. in height, usually found as underwood in Oak stands, but also capable of thriving under Spruce, Pine, Birch, Aspen and Lime stands on better soils. An inventory of stands of this species in the Tartar A.S.S.R., completed in 1942 showed that it was present on 584,400 ha. out of a total of 987,700 ha. (93 per cent. of the forest area of the Republic) reckoned as suitable for its cultivation. The stems averaged 6·5–9 years of age and the yield of root bark per ha. 4·4 (1·6–18·3) kg., the total resource in root bark being assessed at 2,204·8 metric tons. Seventy-five per cent. of this resource is in the sub-zone of broadleaved forest, the stands being densest in medium-moist Oak woods and most productive under canopies of density 0·3–0·7. The maximum yield of root bark was at 14 years of age in the broadleaved and at 17 in the mixed forest, hence everything is in favour of concentrating first on cultivation in the former type. As, however, only the age of the stems was considered in the survey, and as much of the growth is coppice, the maximum yield is provisionally estimated to occur at about 25 years of true age. Although natural regeneration by seed is negligible in comparison with vegetative reproduction, largely from root-suckers, trials have shown that for planting, seedlings (nursery-grown or wildings) and layers are superior to root cuttings. A plan is outlined for the extension of systematic cultivation of *E. verrucosus* in the Republic.

[491]. 34.26 : 12.26–8 : 12.11.11. STEWART, W. S., and HUMMER, R. W. **Inverse correlation between rubber hydrocarbons and insolubles in total solids of latex from *Hevea brasiliensis*.** *Plant Physiol.* 22 (2), 1947 (193–6). [Citrus Exp. Sta., Riverside, Calif., and Dow Chemical Company, Midland, Michigan.] O.B.D.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

See also *For. Abstr.* 9 (Nos. 17, 485–7).

[492]. 34.27 : 12.26–8 : 34.25. PRITZKER, J. **Evaluation of Chestnut flour.** *Mitt. Lebensm. Hyg., Bern* 1941 (207–8). Brit. Abstr. BIII, 1946 (107). P.R.

Criteria used in judging the suitability of Chestnut [*Castanea sativa*] flour for use in the preparation of food products are: microscopical examination of the starch grains, acid value of the flour, and flavour of a cake made with the flour. The acid value of Chestnut flour should preferably be 20, especially when used in the preparation of infant foods, but acid values of up to 30 may be tolerated in mixtures of Chestnut flour with ordinary flour for baking purposes. The use of Chestnut flour as a source of sucrose is suggested.

[493]. 34.27 : 12.26–8 : 12.11.11. KARIM, M. A., and GUHA SIRCAR, S. S. **The fruit-pulp of *Cassia fistula* L.** *Sci. & Cult.* 12 (4), 1946 (194). D.S.I.R.

A chemical analysis of ripe, decorticated and de-seeded fruit pulp of *Cassia fistula*.

[494]. 34.27 : 34.21. PRESTHEGGE, K. **Composition and digestibility of forest waste and other substitute feeds.** *Fôringsforsøk. Norg. LandbrHøgsk.* No. 54, 1943. pp. 73. Brit. Abstr. BIII, 1946 (79). P.R.

Fresh needles of Spruce, Pine and Juniper, Birch twigs, and bark of Aspen, Mountain Ash and Pine were used in digestibility experiments with sheep. The needles were equal to wheat straw in digestibility of organic matter, whereas Birch twigs were inferior, and bark somewhat better. Content of feed units, on dry matter, followed the same order. Content of digestive protein was low. Ca was high, but P low, in all the materials. The needles contained as much carotene as did good hay, and there was some also in the barks. Forest waste is a good winter fodder for sheep and goats and an emergency feed for cattle. Analysis of fresh leaves of Mountain Ash, Alder, Aspen, and Birch showed that they are a good source of Ca and P, and contain very large quantities of carotene. They well supplement a ration deficient in vitamins and minerals. Numerous references are given.

[495]. 34.27 : 12.25. JONES, C. S. **Palconia, a new vegetable fibre.** *Fibres, Fabrics & Cordage* 13 (3), 1946 (113). L.S.

Palconia is made from Redwood bark by the Pacific Lumber Co. of San Francisco, California. Only certain portions of the bark, found between the outer and inner layer, are suitable. The fibres range from $\frac{1}{8}$ to $\frac{1}{2}$ inch in length, but it is claimed that their peculiar form makes them suitable for blending with wool of a much longer staple, forming a mixture particularly suitable for the manufacture of blankets, suitings and felts.

[496]. 34.27 : 12.26–8. CHEVALIER, A. Les arbres à Kapok et les autres producteurs de soies végétales. **[Kapok trees and other sources of vegetable floss.]** *Rev. int. Bot. appl. Agric. trop.* 26 (287/8), 1946 (517–24). [F.] P.R.

A recapitulation is made of the main sources of kapok fibre in Asia, Africa and South America. Species of *Ceiba* and *Bombax* and the kind of kapok they produce are briefly described. A note on *Asclepias* and *Calotropis* as sources of fibre is added.

[497]. 34.27 : 12.26–8. ROEHRICH, O. La fibre du Kapok à fleurs rouges des savanes du Soudan (*Bombax angulicarpa*). **[The fibre of the red-flowered Kapok of the savannas of the Sudan (*Bombax angulicarpa*)].** *Rev. int. Bot. appl. Agric. trop.* 26 (287–8), 1946 (525–8). [F.] P.R.

[498]. 34.27 : 12.29 (75). ROBINSON, B. B. **Minor fiber industries.** *Econ. Bot.* 1 (1), 1947 (47–56).

Includes an account of the production of a valuable fibre from the spathes of the leaf stalks surrounding the terminal bud of *Sabal palmetto*.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

See also *For. Abstr.* 7 (No. 350).

[499]. 35 (410) : 09.4. **Fifth census of production 1935. Part iv: section I. Final report on the building and contracting trade; clay and building materials trades; timber trades.** Board of Trade Statistics Department, London, 1945 (repr.). pp. 96–127. P.R.

[500]. 35 (410) : 98.3 : 12.25. **Trends in softwood importation between the wars.** *Timber News* 54 (2087), 1946 (310–2). P.R.

The article contains figures (compiled by the National Sawmilling Association) for sawn and planed and dressed softwood imports into Great Britain for the years 1924 to 1945 inclusive. A diagram gives a comparison of the amounts contributed by the various exporting countries.

[501]. 35 (410) : 12.26–8 : 31.0. PAGE, P. R. **Marketing Birch.** *Quart. J. For.* 47 (1), 1947 (13–4).

In Lincolnshire, where *Betula pendula* and *B. pubescens* occur in mixture, there is a good local market for Birch coppice as peasticks, flower sticks, beansticks, hedge stakes. Thinnings are in demand by turnery works. Birch fence posts are very durable if completely barked. Logs too crooked for these uses make good firewood.

[502]. 35 (47.1 : 4) : 98. PÖNTYNEN, V. Suomen metsätalouden ja metsäteollisuuden toimintamahdollisuuksista Manner-Euroopan markkinoiden varassa. **[The possible rôle of forestry and the wood industry of Finland in the Continental European markets.]** *Acta forestalia fennica* 50 (11), 1942. pp. 15. [Fi.g.]

[503]. 35 (47.1) : 92. GRIPENBERG, H. Virkesreglementeringen i Finland. **[Timber-trade control in Finland.]** *Skogen* 34 (10), 1947 (158–60). [Sw.]

In view of war-time fuel difficulties, the Finnish Ministry of Supply, by a law of June 21st, 1940, was given a free hand on practically all questions affecting fuelwood, and continued to control its production and distribution throughout the war. By the autumn of 1944, when traffic across the Baltic was interrupted, the situation again became critical, and since timber consumption had risen, coal imports had stopped and inflation was imminent it was clear that further control was necessary, and by a law of April 14th, 1945, the Ministry of Supply was given almost complete control over trade in wood in all its forms. Eighteen local timber boards, whose members were appointed by the Ministry on the recommendations of forestry and industrial organizations, were set up to give effect to the regulations made. The Ministry of Supply, subject to Cabinet approval, determines separate quotas to be obtained from State and private forests in the felling season and distributes these over the local timber-board areas, specifying quotas to be made up for fuelwood, stacked wood and timber. The local timber boards then determine quotas for each forest estate and inform the producers that these quantities must be sold within the season, i.e. the boards are able in effect to order compulsory felling for sale. On the consumers' side, all buyers must belong to certain central organizations by which purchase quotas are allotted to each enterprise from the total quotas fixed by the Ministry of Supply. The final distribution of purchase rights to individual forests is handled by the local timber boards, and thereafter purchase is compulsory.

An owner felling timber in excess of his quota is free to sell the surplus to any buyer, though controlled prices still apply and the transaction has to be reported to the local timber board.

The law is valid until June 1st, 1947. Though it has aroused a great deal of criticism, it is considered to have served its purpose. The Government is seeking the continuation of its powers in this matter for another year but intends to keep only fuel wood and pulpwood under control during that period.

[504]. 35 (492). SOEST, J. VAN. Relatieve houtprijzen. **[Relative timber prices.]** *Ned. Boschb.-Tijdschr.* 17 (11), 1945 (300–3). [Du.]

From a rough analysis of the not altogether satisfactory figures available for Dutch timber prices in 1937–40, graphs are derived to show the relative prices of I- and II-grade Oak, Beech, Scots Pine and Poplar by diameter. Of these only Oak shows a continuous and steep rise in relative price with increasing diameter above about 15 cm.; the curves for the remainder are comparatively flat and remain in roughly the same relation to each other, as postulated by Ostwald, Krieger and others. A more detailed study is greatly to be desired.

[505]. 35 (73) : 98 : 09.4. DIETZ, M. A. **Peacetime lumber demands. Part 2. Character of postwar lumber demand.** *Industr. Ref. Serv. U.S. Dep. Comm.* 4 (Part 6, No. 23), 1946. pp. 5.

The report contains figures for the U.S. consumption of timber in selected manufactures in 1940, softwood and hardwood timber exports from the U.S. by country of destination 1929–41, and an estimation of the available annual wood waste in the U.S.

[506]. 35 (75.6). WACKERMAN, A. G. **Forest products marketing problems in the Piedmont region of North Carolina.** *Bull. Duke Univ. Sch. For.* No. 12, 1945. pp. 62.

38. CONSTRUCTIONAL WORKS. ENGINEERING

See also *For. Abstr.* 9 (Nos. 344–7).

[507]. 38 : 01.6. **Partial list of Government publications of interest to architects, builders, engineers, and retail lumbermen.** *Rep. U.S. For. Prod. Lab., Madison* No. R1081, 1947. pp. 20. P.R.

38.2. *Building Construction. Foundations and Superstructures*

See also *For. Abstr.* 9 (Nos. 334, 366–8, 378).

[508]. 38.2 (410). YORKE, F. R. S. [Editor]. **Specification.** The Architectural Press, 45, The Avenue, Cheam, Surrey, 1946. pp. 974.

The 48th, and first post-war, edition has been entirely re-set, and compressed so as to allow room for much new material in all sections, the re-writing of four sections (Bricklayer, Electrical Engineer, Flooring Materials, Plumber), and the addition of a new section on School Equipment.

[509]. 38.2 : 31.27. SEILER, J. F. **Wood beams reinforced for horizontal shear.** *Wood Pres. News* 25 (3), 1947 (18–22, 26). P.R.

Tests conducted at the University of West Virginia to determine the effectiveness of spiral dowels as reinforcements for timber beams, showed that the resistance of wood members to horizontal shear can thus be materially increased. A preliminary analysis of the tests is given, and formulae and rules for spacing the distances and clearances are suggested. Deep beams may be built up by dowelling together two or more shallow sections, and badly checked beams may be reclaimed by placing dowels in appropriate areas.

[510]. 38.2 : 33.36.3. FICKES, C. P., and GROBEN, W. E. **Building with logs.** *Misc. Publ. U.S. Dep. Agric.* No. 579, 1945. pp. 56.

Instructions, illustrated with photographs and diagrams, for building log cabins. In U.S., winter-felled logs are best, and they should be trimmed, peeled, and stored well above the ground for at least 6 months before using. Logs should be stored in a single tier with 2–3 inches between them to permit complete exposure to the air.

38.6. *Drainage*

[511]. 38.62 : 72 : 78. SAARI, E. Metsäojitusten yksityistaloudellisen edullisuuden määrääminen. [**Calculation of the profitability of forest drainage works.**] *Acta forestalia fennica* 50 (16), 1942. pp. 40. [Fi.g.]

4. FOREST INJURIES AND PROTECTION

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.1. *Air Currents*

See also *For. Abstr.* 9 (No. 632).

[512]. 42.1 : 22.13 : 22.14.2. **Group cutting successfully reduces windfall losses.** *Rep. Rocky Mt. For. Range Exp. Sta. 1946*, [1947?] (37–8).

Three cutting systems, alternate clear-cut strips, salvage group-selection or a two-cut system, have been under study since 1944. To date the area harvested by the salvage group-selection system has shown least loss from windthrow (56 bd.ft. compared with 87 bd.ft. and 161 bd.ft. respectively). Cutting by this method removed 60 per cent. of the merchantable volume of the stand, 50 per cent. being cut from small groups of trees and the remaining 10 per cent. from overmature trees between the groups.

42.2. *Temperature Influences*

See also *For. Abstr.* 9 (Nos. 110, 200).

[513]. 42.21 (485) : 31.8. BERGMAN, F. A. Frostskador på skog. **[Frost damage in the forest.]** *Skogen* 34 (8), 1947 (128). [Sw.]

Notes from Scania. As a result of the recent severe winters, frost cracks are common in *Quercus robur* (sensu lato), *Fraxinus excelsior* and *Fagus sylvatica*; a frost crack 2–2½ cm. wide and 180 cm. long in the stem of *Tilia* sp. is also figured. 'Frost heart' of *Fagus sylvatica* occurred in 1941–42, often beginning only at a height of ½ m. or more above stump level, apparently owing to the deep snow of that winter. Vigorous woods on good sites showed a smaller percentage of 'frost heart' than slow-growing trees on poorer ground; young trees were practically unaffected, whereas in the equally small but heavily suppressed underwood of old stands, 'frost heart' was the rule rather than the exception. A further type of damage occurred in the killing of parts of the cambium in the lower part of the stems, an injury not evident until later, when the bark split in a manner resembling that caused by sun scorch.

A 45-year-old stand of *Abies alba* in Ekeröd Crown Park showed a dark red-brown coloration at the butt, simulating heartwood but irregular at the circumference, in almost all stems removed in thinning. Farther up the stem the coloration was lighter, almost lead-grey at the periphery, and only 1–2 cm. or so of the peripheral wood was the normal white in colour. The discoloration could be traced out into the branches also. It might possibly be due to precipitation of Fe compounds in the wood.

[514]. 42.21 : 12.25 (492) : 12.21. VOORBEIJTEL CANNENBURG, W. Een ernstige ziekte in Corsicaansche den. **[A serious disease of Corsican Pine.]** *Ned. Boschb.-Tijdschr.* 15 (5), 1942 (242–4). [Du.]

Cf. *For. Abstr.* 8 (No. 2696).

42.3. *Precipitations*

[515]. 42.32 : 12.25 (410). GALE, B. **Observations from the Isle of Man: recovery of storm-damaged trees.** *Quart. J. For.* 47 (1), 1947 (16).

Plantations of Sitka Spruce were badly damaged in the glaze storm early in 1940 and it was considered that clear-felling and replanting were necessary. Since war-time conditions made that impossible, treatment was restricted to taking out those trees which could obviously not recover; anything with life and a straight stem was left. This process was carried out every 2 years. Now, 6 years after the disaster, the plantation has largely recovered. There are many instances of Sitka Spruce, 25–30 ft. high in 1940, which had 10 ft. broken off, on which a new crown has developed to its former height. Obviously the loss of increment is considerable, but less than would have been incurred by felling and replanting.

42.5. *Chemical Influences. Nutrient Deficiencies*

See also *For. Abstr.* 9 (No. 535).

[516]. 42.5 : 12.25 (94) : 11.47.1 : 34.6 : 33.1. AUSTRALIA. **[Physiological troubles of *Pinus radiata*.]** *Rep. For. Bur. Aust.* 1946 (8).

An experiment established in 1944 on a 'yellowing' area on 'Young Sand' yielded interesting results. Various fertilizers were applied to 4-year-old trees with the object of

discovering a means of improving health and growth on such sites. The application of animal manure resulted in a striking improvement in the health and increment of the trees. The application of Pine sawdust resulted in a small but definite response in health and growth. None of the chemicals applied gave any positive result.

[517]. 42.5 : 12.26–9 (75.9). DICKEY, R. D. **A manganese deficiency of Palms and some other ornamental trees in Florida.** *Proc. 21st nat. Shade Tree Conf.* 1945 (98–103).

42.6. *Electrical and Cosmic Influences*

[518]. 42.61. SHIPLEY, J. F. **Lightning and trees.** *Weather* 1 (7), 1946 (206–10). L.S.

A brief, largely historical summary prepared for a committee of the British Standards Institution which was dealing with a Code of Practice (*CP* 1 : 1943) on methods of protecting structures against lightning (including a section on the protection of trees). It is suggested that few who have so far written on lightning are aware of the conditions affecting its distribution over definite areas, and that available statistics relating number of trees struck to type of ground are largely devoid of interest, because lightning storms are the result of large-scale atmospheric phenomena and are almost independent of the ground structure.

[519]. 42.63 : 11.16.1. SOBRINHO, V. Os raios cosmicos e sua influência sôbre a vida vegetal. [**Cosmic rays and their influence on plant life.**] *Arqu. Inst. Pesqu. agron.* 4, 1946 (81–9). [Port.] I.F.B.

43. FOREST FIRES

See also *For. Abstr.* 9 (Nos. 158, 589).

43.0 *Predisposing Factors and Causes*

[520]. 43.0. EDLIN, H. L. **Hourly variations in the incidence of forest fires.** *Forestry* 20, 1947 (26–9).

The writer has analysed the recorded times of occurrence of 619 fires on Forestry Commission lands in the New Forest Conservancy of Southern England between 1926 and 1942. He finds that only 7·1 per cent. of these fires occurred between midnight and midday, and 92·9 per cent. occurred between midday and midnight. He attributes the variation partly to weather and partly to the degree of human activity during the hours in question, and concludes that precautions against forest fires should be most intense in the afternoon. *From author's summary.*

[521]. 43.01 : 43.13. HAYES, G. L. **Forest fires and sea breezes.** *Fire Control Notes* 8 (2/3), 1947 (30–3).

Spot fires starting upwind from going forest fires have been observed on a number of occasions on Long Island. It was observed that the smoke column, after rising high in the air, turned and moved back in a direction opposite to the surface winds. The spot fires were started by embers which fell from this smoke column. On other occasions, surface winds changed direction abruptly in mid-afternoon, carrying going fires in an unexpected direction and upsetting suppression plans. The type of local winds known as sea breezes was responsible for both these phenomena. An account is given of the characteristics and external factors influencing sea breezes.

43.1. *Protective Measures*

See also *For. Abstr.* 9 (Nos. 215, 462).

[522]. 43.1 : 07.7. GODWIN, D. P. **Helicopters for forest fire control.** *Quart. nat. Fire Prot. Ass.* 40 (1), 1946 (33–8). D.S.I.R.

A discussion of types of machine and their suitability for forest fire control.

[523]. 43.11 (79.5) : 34.21 : 11.62 : 97.2. ADAMS, F., EWING, P. A., and HUBERTY, M. R. **Hydrologic aspects of burning brush and woodland-grass ranges in California.** Division of Forestry, Department of Natural Resources, California, 1947. pp. 84.

Report of a committee of hydraulic engineers and irrigationists appointed by the California State Board of Forestry. It follows the plan of giving summaries of a number of previous reports on experiments, views of various persons and institutions, etc., with a view to bringing the complexities of the problem into focus. The experimental data which are reviewed are mainly from the following

sources:—(1) P. B. Rowe, *Some influences of woodland-chaparral vegetation on water-soil relations* (an unpublished MS, based on experiments at North Fork, Madera Country, Calif.). (2) Experiments by the School of Forestry, University of California, reported in a series of papers by J. Kitteridge and A. W. Sampson [cf. *For. Abstr.* 3 (105), 6 (189), 7 (No. 135)]. (3) University of California Agricultural Experiment Station Committee on range land utilization; partly from various published reports by Professor F. J. Veihmeyer; and partly from a more complete, unpublished, report which is in part abstracted in the present publication.

The authors' conclusions and recommendations are as follows:—

(1) In view of the contradictory evidence, burning can at present be neither supported nor condemned for all conditions and situations in the California brush and woodland-grass ranges or catchments.

(2) Available experimental data do not provide a basis for the conclusion that burning the ranges in Northern California is adverse to water conservation.

(3) It is very desirable that the research programme on the hydrological aspects of brush and woodland-grass burning should be expanded and that the agencies engaged in research should co-operate more closely than they have done in the past, and especially that they should reach closer agreement on technique and procedure.

(4) Although much more expensive than plot experiments, measurements of run-off and erosion on larger areas are needed.

(5) Since what stockmen wish to do is, not to burn every year, but only periodically (every 4 to 7 or 8 years according to how rapidly brush returns), it is desirable that research programmes should include comparisons of run-off and erosion from covered and periodically burned areas.

(6) It is desirable to distinguish between burning in the ranges and burning in the true forests and in the chaparral areas that are not used for grazing. Distinctly different problems and objectives are involved.

[524]. 43.11 (79.5) : 34.21 : 97.2 : 12.19 : 11 : 91.1. SHANTZ, H. L. **The use of fire as a tool in the management of the brush ranges of California.** Division of Forestry, Department of Natural Resources, California, 1947. pp. 156.

The writer was commissioned by the California State Division of Forestry to review the available literature on the effect of fire on vegetation with particular reference to the chaparral type, as a companion study to that on the hydrological effect of burning [cf. preceding abstract]. He emphasizes the need for much more research into the ecology of brush communities, the secondary successions initiated by burning and the effects of heavy grazing and fire.

[525]. 43.11 : 12.25 (728.2). BRITISH HONDURAS. **[Causes and prevention of fire on the Mountain Pine Ridge.]** *Rep. For. Dep. Brit. Hond. 1945*, [1946], para. 20.

Research is being made into the causes and prevention of fire on the Mountain Pine Ridge. The worst cause of the continuous spread of fires was found to be dead Pine, which burned for several days and threw off burning fragments which might fall 150 feet away on the leeward side and start another fire. On most nights dew caused the fire to die down to such an extent that it could be put out. A study of the burned area showed that Pine trees [*Pinus caribaea*] over 12 ft. high could resist all but the severest fires, and that early burning of the bulk of the Pine ridge, coupled with complete protection of one section at a time, would be the most effective treatment.

[526]. 43.11 : 12.25 : 23.1. CHAPMAN, H. H., and HALL, W. L. **Prescribed burning in the Loblolly Pine type.** *J. For.* 45 (3), 1947 (209–12).

A correspondence between two foresters with long experience in the U.S. southern Pine type. Chapman advocates early burning in order to reduce fire hazard and competition from undesirable hardwoods. Hall is opposed to the silvicultural use of fire on the ground (1) that it may destroy Pine seedlings, (2) that it will not *eradicate* hardwoods, (3) that it is impossible to obtain the necessary labour, and (4) why destroy the hardwoods, anyway?

[527]. 43.11 : 32.29.2 (78.6 : 79.6). LYMAN, C. K. **Slash disposal as related to fire control on the national forests of Western Montana and Northern Idaho.** *J. For.* 45 (4), 1947 (259–62).

There is a general desire for a flexible rule for slash disposal and the writer suggests that the only practicable means of defining slash-disposal objectives is in terms of permissible area of burn or maximum size of fires which can be permitted without violating standards of 'adequate' protection. An acceptable slash-disposal objective for the region as a whole might be the reduction of slash volumes sufficiently to assure control of fires, during all but the most critical weather, before they spread over more than 100 acres, but the permissible size should be varied from area to area according to the menace created by the different conditions of fuels, topography, and weather.

[528]. 43.13 : 07.7. RANDALL, A. G. **Building a cooperative tanker.** *Fire Control Notes* 7 (3), 1946 (30–2).

Account of the construction of a fire tank truck from an ordinary 1½-ton truck chassis, a portable pump, and miscellaneous material, by the staff of Herney National Forest and the fire service of Hot Springs.

43.2. *Fire Insurance*

[529]. 43.2 (44) : 92. GRANDCOURT DE MUSSET, O. DE. Les indemnités pour dommages causés par incendie de forêt. **[Compensation for damage caused by forest fires.]** *Rev. Eaux For.* 85 (3), 1947 (188–93). [F.]

The writer reviews a number of judgments delivered in French courts of law and concludes that, for purposes of compensation for damage due to forest fires, the value of the damage ought to be calculated as at the date on which the award is made, rather than at the date of the fire or the date of actual payment.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

[530]. 44.7. HUNT, N. R. **Destructive plant diseases not yet established in North America.** *Bot. Rev.* 12 (10), 1946 (593–627).

A summary of the chief factors affecting the destructiveness of plant pathogens and of the measures recommended to ensure protection against foreign plant diseases likely to be introduced.

[531]. 44 (71 : 73). STEVENS, N. E., and STEVENS, R. B. **Plant diseases during the years 1941-1945 in the United States and Canada.** *Bot. Rev.* 13 (2), 1947 (92–115). [Univ. of Illinois, and Alabama Polytechnic Institute.]

Sections are included on Mimosa (*Albizzia julibrissin*) wilt, phloem necrosis of Elm, and Dutch Elm disease. The occurrence of these diseases in the United States is indicated by means of distribution maps.

44.1. *Forest Weeds*

See also *For. Abstr.* 9 (Nos. 51, 220, 239–40).

[532]. 44.1. DROST, P. J. Gebruik van katoenafval in de bosschen. **[Use of cotton-mill waste in the woods.]** *Ned. Boschb.-Tijdschr.* 14 (1), 1941 (25–7). [Du.]

In small-scale trials in the cotton-spinning district of Twente (no records were kept of quantities used, composition of the waste, or costs), cotton-mill waste, spread over the ground in plantations, is claimed to have destroyed weeds completely (especially heather), to have itself disappeared rapidly, to have had a favourable influence on the soil and promoted growth of the trees. On account of its lightness it is readily transported in quantity and is easy to spread over the ground.

[533]. 44.1 (94). CASHMORE, A. B., and CAMPBELL, T. G. **The weeds problem in Australia: a review.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 19 (1), 1946 (15–31).

[534]. 44.1 : 12.26–8. CROOKS, D. M., and KEPHART, L. W. **Poison-ivy, Poison-oak and Poison Sumac, identification, precautions, eradication.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1972, 1946. pp. 30.

[535]. 44.1 : 23.26 : 12.25 : 42.5. JOHNSON, A. G. **Some effects of '2,4-D' on Pines.** *J. For.* 45 (4), 1947 (288–9).

Seedbeds containing *Pinus contorta* var. *latifolia*, *P. densiflora*, and *P. rigida*, were sprayed with a commercial weed-killer containing 2,4-dichlorophenoxy-acetic acid and a suitable wetting agent, in order to control sow-thistle. Some seedling Pines were killed; those receiving sub-lethal doses were abnormally stimulated for a time, but have apparently recovered. Seedlings of the year died more

quickly than those in their second season. The same chemical was also tried on *Cirsium arvense* occurring in an established planting of *P. sylvestris* 2–3 ft. tall. No damage was noted on Pines accidentally receiving slight amounts of spray. Standard-strength solutions of 2,4-D were found to be highly effective in the destruction of *Ribes americanum*.

[536]. 44.1 : 24.31. BLANCHARD, R. K. **Killing brush with 2,4-D.** *Fire Control Notes.* 8 (2/3), 1947 (13–17). [California Forest and Range Experiment Station.]

The effects of 2,4-D on the brush species of California, when applied in the form of a spray, were ambiguous, but it seems clear that at any rate the more susceptible species have their sprouting much reduced by treatment. Spray should be applied only to low brush (2–3 ft. high), between the spring flush and the end of July. A list is given of the principal brush species, graded according to susceptibility, and instructions in the preparation and use of 2,4-D.

44.3. *Fungi*

See also *For. Abstr.* 9 (Nos. 102, 260, 330, 514).

[537]. 44.3 : 12.25 : 12.21 : 23.51. VLOTEN, H. VAN. *Fomes annosus* Fr. in onderplantingen. [***Fomes annosus* in underplanted stands.**] *Ned. Boschb.-Tijdschr.* 15 (7), 1942 (337–8). [Du.]

In stands of Scots Pine underplanted with conifers such as Douglas Fir and Japanese Larch there is a danger that the new crop may be infected from stumps of the overwood; these, in the author's opinion, should be removed before underplanting is done.

[538]. 44.3 : 12.25 : 12.21. KONING, H. C. *Phomopsis*-kanker van *Larix* en douglas. [***Phomopsis* canker of Larch and Douglas.**] *Ned. Boschb.-Tijdschr.* 16 (3), 1943 (129–37). [Du.du.]

The parasitism of *Phomopsis pseudotsugae* on *Larix leptolepis* and *Pseudotsuga taxifolia* was proved by inoculation experiments. Cankers are formed on stems and the thicker branches; thin branchlets, or thicker branches existing under unfavourable conditions, may die back as a result of the attacks. Wounds are necessary for infection: mere stripping of needles gives insufficient wounding, but the frozen tips of young branches will give entrance to the fungus. During the resting period of the trees, the fungus is able to spread easily, so that large cankers develop or large portions of branches die back. In the summer, the trees rapidly form callus, closing the wounds and limiting the attack. No systematic observations have yet been made on the distribution of the disease in Holland. *From author's summary.*

[539]. 44.3 : 12.25 : 12.21 (7). PRINCE, A. E. **The biology of *Gymnosporangium nidus-avis* Thaxter.** *Farlowia* 2 (4), 1946 (475–525). I.M.I.

Taxonomy (*nidus-avis* = *juvenescens*); geographical distribution; life history of the spermogonial, aecial and telial phases; the pomaceous hosts and their relative susceptibility to *G. nidus-avis*; the average degree of susceptibility of the three telial hosts (*Juniperus virginiana*, *J. scopulorum* and *J. horizontalis*); a list of immune species; and economic importance and control.

[540]. 44.3 : 12.25 : 12.21. DAVIDSON, R. W., CHRISTENSEN, C. M., and DARLEY, E. F. ***Polyporus guttulatus* and *Ptychogaster rubescens*.** *Mycologia* 38 (6), 1946 (652–63). P.R.

Fruiting bodies of *Polyporus guttulatus* were found associated with brown butt rots of dead and living Black Spruce (*Picea mariana*) and other coniferous species or their stumps in Minnesota. Cultures from the sporophores of *P. guttulatus* from decayed Black Spruce resembled cultures of *Ptychogaster rubescens* from other sources. Cultures of *P. rubescens* grew faster than, and had a slightly different temperature range from those of *P. guttulatus*. A Cypress log inoculated with a pure culture of *P. rubescens* developed a *Polyporus* sporophore tentatively identified as *P. guttulatus*. The writers suggest that *P. rubescens* may be only a variety of *P. guttulatus*.

[541]. 44.3 : 12.25 : 12.21 (410). GALE, B. **Observations from the Isle of Man: fungal disease in Sitka Spruce.** *Quart. J. For.* 47 (1), 1947 (18).

An unidentified disease has recently appeared, killing Sitka Spruce of 20 years of age in six months. The symptoms are a thinning of the foliage with an exudation of resin all round the tree just below the surface of the humus.

Quantities of white mycelium are present in the bark at the base of the tree and in the surrounding humus, and small yellow, mushroom-shaped fructifications about 1 mm. in diameter have been found at the base of the infected trees.

[542]. 44.3 : 12.25 : 12.21. RIKER, A. J., KOUBA, T. F., and HENRY, B. W. **The influence of temperature and humidity on the development of White Pine blister rust on *Ribes* leaves.** *Abstr.* in *Phytopathology* 37 (1), 1947 (19).

The influence of environment on infection of *Ribes* by *Cronartium ribicola* has been studied both in the greenhouse and at the Wisconsin blister-rust nursery where White Pines are being selected for rust resistance. Uredia developed on *Ribes nigrum* at constant temperatures of 16°, 20°, 24° and 28° C. With increasing temperatures, incubation time was shorter; area involved was larger; subsequent leaf necrosis was greater. Telia developed as follows: abundant at 16°, good at 20°, occasional at 24°, and none at 28° C. The amount of infection on leaves kept in a fog for 5 to 12 hours increased progressively with time. The development of rust in the nursery was closely correlated with that at corresponding temperatures in the greenhouse. These results help to clarify the observations (1) that telia seldom develop well on most species during hot weather, and (2) that hot weather improves the chances for White Pine to escape infection.

[543]. 44.3 : 12.25 : 12.21 : 12.11.3. VLOTEN, H. VAN. Korte mededeeling over de proef met *Pinus strobus* van verschillende herkomst uit Noord-Amerika. [**Brief report on the trial of different North American provenances of *Pinus strobus*.**] *Ned. Boschb.-Tijdschr.* 14 (7), 1941 (345–6). [Du.]

Preliminary results from a test of 43 provenances of *P. strobus* exposed to as great a chance as possible of infection by *Cronartium ribicola*, showed that although severe infection could be found in all provenances, not all developed aecidia, and the percentage of plants showing aecidia varied in different lots from 0 to 72. The plants without aecidia were unfortunately not the best growers. Only continued observation can determine whether the differences so far observed are in fact differences of natural resistance.

[544]. 44.3 : 12.25 : 12.21 (71.1) : 22.88.2. BIER, J. E., and BUCKLAND, D. C. **Relation of research in forest pathology to the management of second growth forests. I. *Poria weirii* root rot, an important disease affecting immature stands of Douglas Fir.** *B.C. Lumberm.* 31 (2), 1947 (49–51, 64, 66).

Root rot caused by *Poria weirii* has been found to interfere seriously with the stocking of naturally regenerated stands composed predominantly of Douglas Fir. Extensive damage has been observed in young stands of pure Douglas Fir, the disease spreading from centres of infection and the fungus attacking vigorous trees as readily as the suppressed. The disease occurs as abundantly on good as on poor sites. Careful examinations should be made for the presence of this fungus in all immature stands to be placed under management. Unless depletion from this cause is provided for as part of the management policy, grossly inaccurate figures may be obtained for all estimates of future growth and yield.

[545]. 44.3 : 12.26–9 : 12.21 : 46 : 91.4. MILLER, P. A. **Notes on diseases of some Southern California shade trees.** *Proc. 21st nat. Shade Tree Conf.* 1945 (8–12).

Notes on (1) bleeding disease of *Eucalyptus ficifolia*, caused by *Dothiorella gregaria*, the imperfect stage of *Botryosphaeria ribis*; (2) *Penicillium* disease of Palms, notably *Phoenix canariensis*; (3) dieback of trees in picnic areas of municipal parks, caused by soil compaction and drought. In one park, the picnic area is disked and fertilized once a year in the autumn before the winter rainy season, a practice which largely overcomes the harmful effects of soil compaction during the summer.

[546]. 44.3 : 12.26–8 (71.4) : 47. POMERLEAU, R. Inventaire pathologique de la forêt décidue à la station forestière expérimentale de Duchesnay (Québec). [**Pathological inventory of the deciduous forest at the Duchesnay (Quebec) forest experiment station.**] *Rep. Quebec Soc. Prot. Pl.* 1943–44 (69–79). [F.]

Report on a study made during the summers of 1942 and 1943. *Nectria* canker is very common on some sites, particularly on *Betula lutea*, which is usually attacked when growing out of its normal environment or on an eminence; it then forms a focus of infection

from which the disease may spread to *Acer rubrum*, which is very susceptible to it. *Eutypella* canker develops especially on young suppressed Maple. *Fomes igniarius* is the most frequent cause of heartshake, the species most affected being *Fagus grandifolia* and *Acer rubrum*. *Armillaria mellea* does considerable damage, particularly to *B. lutea*.

[547]. 44.3 : 12.26–8 : 12.21. ZABEL, R. A. ***Poria obliqua* on dying Beech.** *Phytopathology* 37 (3), 1947 (189–90).

Poria obliqua is an important wood-decay organism found principally on species of *Betula* and occasionally on *Ostrya* and *Fagus*. On live hosts it was reported to form only rimose, clinker-like masses of sterile tissue, and fertile sporophores were believed to be produced only on dead trees and only after decay was well established. In the vicinity of Tully, New York, in August 1946, a fertile fruiting body of *Poria obliqua* was found on a dying trunk of *Fagus grandifolia*. The sporophore was in intimate contact with the living sapwood. This suggests that live trees bearing sterile, rimose conks might advisably be removed from the forest during sanitation cuttings.

[548]. 44.3 : 12.26–8 : 22.22 : 24.51. UNITED STATES. [**Early measures needed to reduce rot in sprout Oaks.**] *Rep. U.S. Bur. Pl. Ind.* 1946 (52).

Studies begun 10 years ago now provide clear evidence that measures to minimize decay in coppice Oak stands should be taken before the trees are 15 years old. Where one of a pair of twin sprouts is removed, leaving a wound more than 4 in. wide, healing is very slow and decay is likely. Shoots that arise highest on the parent stumps and that are therefore most likely to develop butt rot, dominate the stand. Pruning wounds more than 1½ in. wide will often lead to decay, while smaller wounds are usually safe from decay.

[549]. 44.3 : 12.26–8 : 12.21. TWYMAN, E. S. **Notes on the die-back of Oak caused by *Colpoma quercinum* (Fr.) Wallr.** *Trans. Brit. mycol. Soc.* 29 (4), 1946 (234–41 + plate). [Univ. of Birmingham.] O.B.D.

Colpoma quercinum is an inoperculate, phacidiaceous discomycete causing die-back of Oak trees. The hyphae travel in a longitudinal direction in the vessels and tracheids and in a radial direction in the medullary rays. The natural progression of the mycelium of the fungus from infected to healthy branches is usually basal. A gum barrier laid down between infected and healthy wood contains a ligno-tannin complex. *From author's summary.*

[550]. 44.3 : 12.26–8 : 12.21 (493). ROLAND, G. Étude faite sur un trachéomycose du Chêne occasioné par un *Diplodia*. [**Study on a tracheomycosis of Oak caused by a species of *Diplodia*.**] *Parasitica* 1 (1), 1945 (11–34 + plate). [F.flem.] [Station de Phytopathologie de l'État à Gembloux.] I.M.I.

[551]. 44.3 : 12.26–8 : 12.21 (44). MOREAU, C. Une Lophiostomacée nouvelle sur rameaux de *Fraxinus excelsior* L. [**A new species of the Lophiostomaceae on branches of *Fraxinus excelsior* L.**] *Bull. Soc. bot. France* 93 (5/6), 1946 (126–8). [F.] O.B.D.

Platystomum (*Lophidium*) *fraxinicolum* n.sp.

[552]. 44.3 : 12.26–8 : 12.21 (410). DAY, W. R. **The leaf scorch of Planes, caused by *Gnomonia veneta* (Sacc. and Speg.) Kleb.** *Quart. J. For.* 47 (1), 1947 (22).

This disease, which is endemic and usually unimportant, occasionally reaches serious proportions and may then kill the affected tree. It is possible that these severe infections are associated with wet weather in the spring. It is suggested that, since badly infected trees do not, in any case, recover, it might be worth while to cut out all the infected part of the crown, to the extent of pollarding, in the hope of saving the tree.

[553]. 44.3 : 12.26–8 : 12.21 (492). VLOTEN, H. VAN. Roest van populieren. [**Poplar rust.**] *Ned. Boschb.-Tijdschr.* 14 (7), 1941 (347–50). [Du.]

Inoculations of possible alternate hosts with teleutospores from Poplar leaves showed that: (*a*) in 1939 only *Melampsora laricis-populina* occurred on *Populus serotina* and its var. *erecta*, *P. marilandica*, *R. robusta*, *P. trichocarpa*, *P. generosa* and the 'Androscoggin' and 'Oxford' hybrids of Stout and Schreiner; (*b*) in 1940 *Melampsora allii-populina* appeared; to this *P. robusta* and *P. generosa* were resistant and *P. regenerata* and its var. *erecta* very susceptible (though both relatively resistant to *M. laricis-populina*), while on *P. serotina* and

its var. *erecta* both rusts developed with about equal severity. *P. candicans* appeared to be resistant to both species of rust. On *P. wislizenii*, *P. robusta*, *P. trichocarpa* and *P. generosa* only teleutospores of *M. laricis-populina* occurred. Teleutospores of this species were found chiefly on the upper, and those of *M. allii-populina* chiefly on the lower surface of the leaves.

[554]. 44.3 : 12.26–8 : 12.21 : 12.25 (492). VLOTEN, H. VAN. Roest van populieren. [**Poplar rust.**] *Ned. Boschb.-Tijdschr.* 15 (7), 1942 (339). [Du.]

The aecidial form of *Melampsora allii-populina* was found in 1941 and 1942 on *Allium vineale* in a stand of Poplars at Wageningen. That of *M. laricis-populina* occurred in 1942 on needles of *Larix decidua* planted between Poplars in the grounds of the Laboratorium voor Mycologie en Aardappelonderzoek. This is the first recorded natural infection in Holland of *L. decidua* from telia on fallen Poplar leaves.

[555]. 44.3 : 12.26–8 : 12.21 (410). GREAT BRITAIN. **Elm disease**: ***Ceratostomella ulmi.*** *Leafl. For. Comm., Lond.* No. 19 (revised), 1947. pp. 7.

Revision of a leaflet first issued in 1928. It is recommended that so far as possible all dead trees and branches should be removed. Any felled or windblown Elms which cannot be utilized at once should have the bark stripped off and burned. Elm logs to be used as firewood, if not barked, should be burned during the same winter as they are cut. Owners of suitable hedgerows should, when it can be done without detriment to the fields, allow Elm suckers to grow up to replace those killed by disease. Hedgerow Elms have an appreciable market value.

[556]. 44.3 : 12.26–8 : 12.21. BANFIELD, W. M. **Dutch Elm disease recurrence in American Elms in relation to the extent of vascular invasion by *Ceratostomella ulmi* in the year of disease incidence.** *Abstr.* in *Phytopathology* 37 (1), 1947 (1).

Recurrence of Dutch Elm disease was studied in the season following infection in approximately 700 American Elm seedlings that had developed many degrees of vascular invasion as a result of diverse types, loci and times of infection in the season of initial infection. All trees were in a native stand and varied between 1½ and 4 in. d.b.h. The disease did not recur in 276 trees where vascular invasion was limited to crown branches. It recurred in 2 of 140 trees where vascular invasion was extensive in crown and upper bole, and in 82 of 169 trees where vascular invasion was extensive in crown, bole and roots. Histological examination of these trees revealed vessels of consecutive growth sheaths to be contiguous at numerous points in the root system and in the lower bole. In recovered trees no points were found at which invaded vessels of the sheath of initial infection were in contact with vessels of the new sheath. Invaded vessels of new and old sheaths were contiguous at one or many points in trees in which the disease recurred. Such points of contact were most numerous in the roots, present in the bole, and rare in small branches.

[557]. 44.3 : 12.26–8 : 12.21. BANFIELD, W. M., REX, E. G., and MAY, C. **Recurrence of Dutch Elm disease in American Elms in relation to tree stature.** *Abstr.* in *Phytopathology* 37 (1), 1947 (1–2).

Wilt and die-back symptoms, which reappear in the season following infection in American Elms, result from general invasion of the vessels of the new sheath by *Ceratostomella ulmi* derived from the infected vessels of the preceding sheath. Disease recurrence varies with the tree stature. It recurred in less than 10 per cent. of several hundred trees of 1-in. d.b.h. which survived the initial attack. The disease recurred in 49 per cent. of 169 trees of 2–4·9 in. d.b.h., in 83 per cent. of 36 trees of 5–9·9 in., in 92 per cent. of 27 trees of 10–15 in., and in all 36 trees greater than 15 in. d.b.h. on which observations were made. The disease continued to recur each year until death, in all trees but one. Most trees died in the second season, about a third died in the third season. Three large trees continue as living relics after 5 years of recurring disease.

[558]. 44.3 : 12.26–8 : 12.21. FENNER, L. M., and LIMING, O. N. **Identification of *Ceratostomella ulmi* in pure cultures and in mixed associations of organisms.** *Abstr.* in *Phytopathology* 37 (1), 1947 (7).

[559]. 44.3 : 12.26–8 : 12.21. DIMOND, A. E. **Symptoms of Dutch Elm disease reproduced by toxins of *Graphium ulmi***

in culture. *Abstr.* in *Phytopathology* 37 (1), 1947 (7).

Graphium [*Ceratostomella*] *ulmi*, grown on synthetic media, produces at least 2 metabolites toxic to Elm cuttings. Each toxin produces symptoms typical of a part of the syndrome of Dutch Elm disease. The first, a polysaccharide, produces an upcurling of leaves with marginal withering of the blade, but causes no necrosis. The second fraction, soluble in 70-per-cent. alcohol, produces a striking intervenal necrosis. Ether extraction of this fraction to remove organic acids does not alter its toxicity.

44.4. *Virus Diseases*

[560]. 44.4 : 12.26–8. SIBILIA, C. Le virosi nelle specie forestali. [**Virus diseases of forest species.**] *Ital. for. mont.* 2 (2), 1947 (67–74). [It.]

Notes on leaf curl and phloem necrosis of Elm, two types of little leaf of Lime observed on *Tilia cordata* and *T. platyphyllos* respectively, leaf curl of *Celtis australis*, brooming of *Robinia pseudoacacia*, and some mosaics of 'Canadian' Poplar, Ash and *Cytisus laburnum*. All of these, except the phloem necrosis of Elm, occur in Italy.

[561]. 44.4 : 12.26–8 (73). HUTCHINS, L. M., and WESTER, H. V. **Graft-transmissible brooming disease of Walnut.** *Abstr.* in *Phytopathology* 37 (1), 1947 (11).

Brooming of Black Walnut (*Juglans nigra*), Butternut (*J. cinerea*), Japanese Walnut (*J. cordiformis* var. *ailanthifolia*) in parts of the eastern United States is characterized by brooms or sucker growth on main stems and branches, tufting of terminals, profusion of branchlets from axillary buds, dwarfing of leaves, and sometimes by death of the trees. Symptoms vary from mild to severe on different trees of these species and are particularly pronounced on Japanese Walnut. Transmission of brooming disease has been successful with patch bark grafts in Black Walnut and in Japanese Walnut, the incubation period varying from several months to two years. Transmission by grafting and absence of a visible pathogen suggest that the disease is caused by a virus.

[562]. 44.4 : 12.26–8 : 12.11.22. WALLACE, J. M. **The use of leaf tissue in graft-transmission of psorosis virus.** *Phytopathology* 37 (3), 1947 (149–52).

Inoculation by means of small rectangular pieces of leaf tissue from psorosis-affected *Citrus* trees, placed under bark flaps of healthy *Citrus* trees, usually resulted in infection of 90–100 per cent. of the inoculated trees. Microscopic examination showed that callus tissue developed along the cut edges of the leaf piece and united with callus formed by cambial tissue of the inoculated tree. *Citrus* may be specially adapted for this type of leaf-tissue graft, but the successful transmission of viruses of Sandal and Peach by similar grafts suggests that this method may be applicable to a wide range of plants. *From author's summary.*

45. DAMAGE BY ANIMALS

45.1. *Mammals*

See also *For. Abstr.* 9 (No. 234).

[563]. 45.12 : 12.25 : 13.2. ALLMAN, D. **Observations on damage by hares at Clonegal Forest.** *Irish For.* 3 (2), 1946 (92).

Considerable damage has been done by hares in a plantation where Corsican and Scots Pine are planted in a 50-per-cent. mixture with a few belts of pure Contorta Pine. The area was planted in 1944 and height is 2½–5 ft. The hares have almost ignored both Scots and Contorta Pines, even when alternate in the lines with the Corsican, and have nipped the needles from the main stem and side branches of a large number of Corsican Pines, the damage resembling, at first sight, that caused by Pine sawfly.

[564]. 45.12 : 12.25–8 : 13.2 (71). JACQUES, J. E. Le mulot et ses méfaits. [***Microtus pennsylvanicus* and the damage it causes.**] *Rep. Quebec Soc. Prot. Pl.* 1943–44 (45–54). [F.]

An account of the habits, damage and control of this very destructive rodent, which will attack the bark of almost any species when hungry, but appears to prefer plants of the Rosaceae. It often kills trees by ring-barking, the height to which it reaches depending on the depth of snow. The tender bark of young trees is preferred. Notes are given on poisons and repellents.

45.3. *Insects*

See also *For. Abstr.* 9 (Nos. 51, 174, 176–82, 189, 191, 608–9).

[565]. 45.3 (492) : 22.8 : 13.15. VOÛTE, A. D. Boschbouwdierkundige richtlijnen bij het aanleggen en onderplanten of onderzaaien van bosschen. [**Forest-zoological principles in the establishment of woods, including under-planting or under-sowing.**] *Ned. Boschb.-Tijdschr.* 18 (2), 1946 (25–9). [Du.] [Biologisch Laboratorium 'Hoenderloo'.]

It is held that natural control of pests is better in mixed than in pure forest because the more varied plant life of the former supports a more numerous and more varied fauna, which in turn helps to maintain populations of natural enemies, among which the polyphagous species are especially important, at a level high enough to check incipient outbreaks. The use of exotics needs much discretion from this as well as from other points of view, since (*a*) they may be unacceptable to the native fauna, and (*b*) they may themselves bring pests for which native enemies are lacking. Some exotics, however, will fit into and do good service in communities of native species, e.g. *Prunus serotina* is a valuable addition to Oak/Birch forest in Holland. Others are necessary because of their advantages on special sites, e.g. American Oak [*Quercus borealis*] in Pine plantations on shifting sand. Nectar-producing species are an important source of food, especially for Hymenoptera; Lime and Maple are valuable from this point of view, and among species of the underwood, *Rhamnus frangula* is recommended as one of the best honey-producers.

In general, zoological considerations favour mixtures in the production forest of trees and shrubs that are native to the locality, with the addition, if need be, of exotics that will take part in the life of the community as a whole. The underwood should not be so dense as to prevent the development of ground vegetation.

Many Dutch forests have suffered from the collection of 'ants' eggs', and an investigation is in progress at the Biologisch Laboratorium 'Hoenderloo' on the possibility of artificially restocking such woods with ants.

[Cf. succeeding abstracts and *For. Abstr.* 9 (Nos. 174, 178–10, 590–1).]

[566]. 45.3 (492). VOÛTE, A. D. **Overzicht over de insectenplagen in onze bosschen** en andere houtopstanden in het jaar 1941. **[Review of the insect pests in Dutch forests and other woody growth in 1941 [and corresponding reports for 1942 and 1943].**] *Ned. Boschb.-Tijdschr.* 15 (1), 1942 (12–17); 16 (1), 1943 (1–9); 17 (3), 1944 (87–92). [Du.] [Biologisch Laboratorium 'Hoenderloo'.]

[567]. 45.3 (492). Verslagen over het jaar 1940 van het Comité ter bestudeering en bestrijding van insectenplagen in bosschen. [**Reports for 1940 [and corresponding reports for 1941 and 1942] of the Committee for the Study and Control of Forest Insect Pests [in Holland].**] *Ned. Boschb.-Tijdschr.* 14 (4), 1941 (139–48); 15 (4), 1942 (165–70); 16 (5), 1943 (207–24). [Du.]

The following notes are taken from a special appendix to the report for 1942 by J. J. Fransen:

(i) *Coleophora laricella*: Promising results were obtained from spring spraying with a ½-per-cent. aqueous dinitro-o-cresol solution; tests with sprays and dusts containing this substance were to be continued. Spring dusting with derris preparations containing ⅛–½ per cent. of rotenone, with gypsum or 'dolomite marl' as diluents, was unsuccessful.

(ii) *Cephaleia alpina*: The results are given (4 tables) of preliminary laboratory tests of dusts containing derris, pyrethrum, marigold, $BaSiF_6$ or Na_2SiF_6. Of these, the last-named was the most effective, giving at a concentration of 20 per cent. a complete kill of half-grown larvae, and almost complete control of practically full-grown larvae at a concentration of 10 per cent. in talc. Use of 'dolomite marl' instead of talc reduced the effectiveness of Na_2SiF_6. Calcium cyanamide also appeared to have promise as an insecticide against *C. alpina*; this substance produced no injury to young shoots of several coniferous species in preliminary trials in April-May.

(iii) *Tortrix viridana*: Treatment of an infested area with a dust containing ¼ per cent. of rotenone, 1/160 per cent. of pyrethrum and 33·3 per cent. of $BaSiF_6$ was successful.

(iv) *Diprion pini:* Laboratory tests of $BaSiF_6$ and Na_2SiF_6 showed that neither was effective as a contact poison, and that as a stomach poison the Na salt was the more effective, giving complete control at a concentration in talc of 60 per cent. The effect of

both silico-fluorides was reduced when 'dolomite marl' was used as a diluent. [Cf. also *For. Abstr.* 9 (Nos. 590–2).]

(v) *Dutch plants as insecticides*: Results of tests of preparations of 27 species were not encouraging.

(vi) Some provisional conclusions from tests of the effects of derris with various diluents on fish (golden ide) are reported.

[568]. 45.3 : 12.25–8 : 13.2 (492) : 13.15. ROEPKE, W. Het probleem van de bladwespen in Nederland. **[The sawfly problem in Holland.]** *Ned. Boschb.-Tijdschr.* 17 (2), 1944 (33–40). [Du.]

A general review with chief emphasis on biotic and abiotic factors affecting population levels and on the need for more detailed research on such factors.

[569]. 45.3 : 12.25 : 13.2 (492). VOÛTE, A. D. De stand van het onderzoek van de lariks- en sparrenbladwespen, verricht door of in samenwerking met het Comité ter bestudeering en bestrijding van insectenplagen in bosschen. **[The position of investigations on Larch and Spruce sawflies, made by or in co-operation with the Committee for the Study and Control of Forest Insect Pests in Holland.]** *Ned. Boschb.-Tijdschr.* 17 (2), 1944 (41–5). [Du.]

(i) *Larch sawflies*: *Cephaleia alpina*.—This is now a serious pest in Drenthe, Friesland, and, to a lesser degree, in N. Brabant and Gelderland. Its lower incidence in mixed forest than in pure Larch woods is due to an abiotic factor affecting the larvae physiologically, probably during the period when they are in the soil, and possibly connected with soil moisture. *Nematus erichsoni*.—Studies by Kuiper have so far shown that mice are the most important factor in natural control. Severe winters favour the sawfly, as frost prevents mice from reaching pupae in the soil.

(ii) *Spruce sawflies*: The species responsible for most damage are *Cephaleia abietis*, *Pachynematus scutellatus* and *Lygaeonematus abietinus*. An investigation of the last-named has shown that: (*a*) It has only one generation a year. (*b*) It oviposits on very young needles just after the fall of the bud scales and cannot do so on older needles. (*c*) Larvae are able to crawl from branch to branch, drop when full-grown to the ground and enter the soil (a ground cover of grass, moss or mor being favourable) or, if the soil is too hard, move about to distances up to 1 m. from their point of descent. In the laboratory they can spin a cocoon if denied an opportunity of digging themselves in. (*d*) The chief enemies are mice (which can dispose of large numbers of cocoons), ants (which often catch the larvae on their descent to the ground), and several pupal parasites. (*e*) In general, climate has little effect on the flight period, which coincides roughly with the flushing of Norway Spruce. The main flight, however, is later than the main flushing period of the trees, hence early-flushing trees are generally wholly free from attack or almost so; but in a late spring, flushing is retarded and even early-flushing trees may be attacked. Further, attacked branches flush later in the succeeding year than normal ones on the same tree, thus favouring the continuance of attack. (*f*) Climate has no great effect on mortality of eggs and larvae. Heavy rainstorms and cold reduce the activity of adult females and presumably inhibit egg production to some extent.

It thus appears that woods consisting of late- but not simultaneously flushing trees, or of early- and late-flushing types in mixture, and with a soil cover of grass, moss or mor, and unsuitable for mice, are predisposed to attack. Woods of uniformly late-flushing trees should suffer rather less, and woods of early-flushing trees alone should be largely immune, as also should those where the soil is hard or the mouse population high; which is usually the case in mixed forest. If selection for early flushing were undertaken as a preventive measure, due account would have to be taken of the frost risk in many localities.

Derris preparations are the best for control by dusting. Calcium cyanamide burns hardwood foliage badly, and in 1943 also damaged Spruce needles; it is slower-acting, more dependent on fine weather, and is not now recommended as an insecticide.

The stomach poisons, such as arsenic compounds or silico-fluorides, are dangerous to warmblooded animals. Early dusting is believed to be better than late dusting, as it is thought better to reinforce the natural resistance of early flushing trees, which, if damaged in one year, would tend to prolong the attacks by flushing late in the next.

[570]. 45.3 : 12.25 : 13.2 (492). VOÛTE, A. D., and PELSMA, C. De lariks wespen in Nederland. [**Larch sawflies in Holland.**] *Ned. Boschb.-Tijdschr.* 15 (1), 1942 (18–24). [Du.]

Includes a key to larvae and notes on the importance, type of damage, description, life history and distribution of *Cephaleia alpina*, *Lygaeonematus erichsoni*, *L. laricis*, *Platycampus ovatus* and *P. pectoralis*.

[571]. 45.3 : 13.2 (492) : 23.23.1. LANZ, A. J. Eenige gegevens over naaldhoutzadenvernielende *Megastigmus*-soorten in Nederland. [**Some data on the *Megastigmus* species damaging conifer seed in Holland.**] *Ned. Boschb.-Tijdschr.* 15 (7), 1942 (329–36). [Du.]

A brief review of the life history of the group, followed by a list of the 6 species and their hosts in Holland. Control by fumigating seed with carbon bisulphide is cheap and effective, but accounts only for that portion of the seed crop that is harvested. *M. spermotrophus* is in some years a serious menace to the Douglas Fir seed crop in Holland, and seed of *Abies*, *Larix* and *Picea* is damaged by one or another of the species. The author recommends that all susceptible seed, whether of Dutch or foreign origin, should be fumigated as a matter of course, and any large lots of seed should also be investigated for *Megastigmus* attack.

[572]. 45.3 : 12.25 : 13.2 : 23.23.1. LANZ, A. J. *Megastigmus*-aantasting van naaldhoutzaden in 1942–43. [***Megastigmus* attack on conifer seed in 1942-43.**] *Ned. Boschb.-Tijdschr.* 16 (10), 1943 (410–11). [Du.]

In 1942–43, a good seed year, *Megastigmus spermotrophus* was bred from seed of *Pseudotsuga taxifolia* and *M. pinus crosbyi* from that of *Abies grandis*, the percentages of attacked seed being respectively 7·9 and 1. Seed of 15 other conifer species failed to yield any *Megastigmus*. As, in the previous year, a poor seed year, Douglas Fir seed had shown percentages of infestation of 53 and 65, the present results are believed to offer some confirmation of T. C. Oudemans' opinion that the chance of severe infestation is greater in poor seed years, since the adult female *Megastigmus* concentrates upon fewer cones.

[573]. 45.3 : 12.25–8 : 13.2 (43.6). KURIR, A. Massenauftreten der Nonne (*Lymantria monacha* L.) in den östlichen Alpen (Steiermark). [**Nun-moth (*Lymantria monacha* L.) epidemic in the eastern Alps (Styria).**] *Allg. Forst- u. Holzwirts. Ztg.* 57 (12), 1946 (104). [G.] X.

Records of an outbreak of *Lymantria monacha* in 1946 in the Salza Valley, where the pest was previously unknown.

[574]. 45.3 : 12.25 : 13.2 : 13.15. FRANZ, J. Der Tannentriebwickler *Cacoecia murinana* Hb. Beiträge zur Bionomie und Ökologie. II Teil. [**Contributions to the bionomics and ecology of the Silver Fir shoot Tortricid, *Cacoecia murinana* Hb. Part II.**] *Z. angew. Ent.* 27, 1941 (585–620). [G.g.] [Institut für angewandte Zoologie, München.]

Cf. *For. Abstr.* 4 (130).

[575]. 45.3 : 12.25 : 13.2 : 24.3 : 76 : 31.8. MCCLINTOCK, T. F., and WESTVELD, M. **Some financial aspects of removal of overmature Balsam Fir as a budworm control measure.** *For. Mgmt. Pap. Ntheast. For. Exp. Sta.* 1946. pp. 8.

Overmature, defective Balsam Fir [*Abies balsamifera*] constitutes a high budworm hazard, as such trees provide favourable conditions for a rapid build-up of Spruce budworm [*Cacoecia fumiferana*] populations. Prompt and extensive removal of such trees should materially reduce the intensity of budworm infestation. This paper discusses the results of studies made to determine the amount of salvageable, sound wood in defective Balsam Firs of different sizes, the costs of the various steps involved in harvesting such trees and their ultimate pulpwood values. The paper also throws light on the question of how much cull Balsam Fir may contain and still be worth harvesting. *From authors' summary.*

[576]. 45.3 : 12.25 : 13.2. FILUK, B., and LEJEUNE, R. R. **Spruce budworm biological control study.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (1), 1947 (2).

In the summer of 1946 in the Spruce Woods Forest Reserve, Manitoba, the budworm population steadily declined from 18·1 larvae per 100 terminals in the spring to 4·1 per 100 terminals at the end of pupation. This represents a reduction of 77·3 per cent. made up as follows: larval parasites 45·3, dead, diseased and predators 6·4, pupal parasites 24·8, unknown 0·8 per cent. *Glypta* sp. and *Apanteles* sp.

accounted for practically all the larval parasitism, while several species contributed to pupal mortality. It had previously been believed that a considerable mortality would be due to weather and nutritional factors.

[577]. 45.3 : 12.25 : 13.2 (41.1–4). MACKENZIE, J. M. D. **Larch defoliation by *Orgya antiqua*.** *Scot. For. J.* 60 (2), 1946 (86–8).

A previous note [cf. *For. Abstr.* 7 (No. 2065)] reported a severe infestation of a plantation of Hybrid Larch in 1945. In 1946 there was again complete defoliation, dispersal of larvae and outbreak of disease.

[578]. 45.3 : 12.25 : 13.2 (43.1–5) : 13.15. NIKLAS, O.-F. Zur Lebensweise der kleinen Fichtenblattwespe *Lygaeonematus abietum* Htg. (= *Lyg. pini* Retz.) in verschiedenen Bestandsformen des Forstamtes Eichwald, Ostpreussen. **[On the life habits of *Lygaeonematus abietum* Htg. in various types of stand in the Eichwald forest district of East Prussia.]** *Z. angew. Ent.* 30, 1944 (224–51). [G.g.] [Forstschutzstelle Ost, Forstamt Breitenheide/Ostpr.]

[579]. 45.3 : 12.25 : 13.2 (492). VOÛTE, A. D. Het optreden van den sparrenbastkever (*Dendroctonus micans* Kug.) in ons land en de mogelijkheid tot het voorkomen van de plaag. **[The occurrence in Holland of *Dendroctonus micans* and possibilities of controlling this pest.]** *Ned. Boschb.-Tijdschr.* 19 (3), 1947 (85–7). [Du.] [Biologisch Laboratorium 'Hoenderloo'.]

D. micans has become a serious pest of Spruce woods in Holland, especially of Sitka and Oriental Spruces, though Norway Spruce—in contrast to German and Belgian experience—is very rarely attacked. Attacks are confined to trees over about 35 years old, but involve entirely healthy as well as unsound trees. The life history of the beetle in Holland is briefly described, together with the distinctive features of the larval galleries. No effective control is at present possible. In measures to limit the damage, however, the chief points to remember are that: (i) Sitka and Oriental Spruces of 35 or more years of age are highly susceptible. (ii) Only a few trees are likely to be infested at the onset of an attack, but from such a centre the whole wood may eventually be destroyed. (iii) An attacked tree continues to be re-infested and for several years, while dying, will be a source of infestation in the vicinity. It is recommended that Spruce plantations should be thoroughly inspected each winter, attacked trees felled and barked, their stumps removed and larvae and beetles therein destroyed.

[580]. 45.3 : 12.25 : 13.2 (494). SCHNEIDER-ORELLI, O. Untersuchungen über Auftreten und Überwinterung des Fichtenborkenkäfers *Ips typographus*. **[Investigations on the occurrence and overwintering of *Ips typographus*.]** *Schweiz. Z. Forstw.* 98 (3), 1947 (89–111). [G.g.f.] [Entomologisches Institut der Eidg. Technischen Hochschule, Zürich.]

A report on observations, during the summer and autumn of 1946 and the following winter, on centres of infestation in various parts of Switzerland. In autumn most centres showed a striking decrease, and sometimes the complete disappearance, of the beetles present until then in both larval galleries and those made by the feeding of young adults. Soil sampling revealed that the adults overwinter in the soil cover, not only in places where barking has been done but also where no tree in the infested locality has been felled. They are found in the litter and especially in the mull layer beneath the litter. The densest population as yet found in the soil cover (105 beetles per sq. dm.) occurred between two root spurs of one of 15 standing infested trees. Most soil samples from a centre where the trees had been felled before September and properly barked with all due precautions, were free of beetles.

For control in summer the chief point is to bark all infested logs in good time, using cloths to catch the waste, which should be burnt immediately. If barking cannot be done until later in the summer, control can be much improved by contact poisons, e.g. DDT or hexachlorcyclohexane preparations, applied as dusts during barking. Infested trees are often almost entirely abandoned by the beetles before winter fellings take place, and spring swarming then occurs chiefly from the soil cover. In this case, trap logs are a good means of control, and where fairly large clear fellings are made in winter it is advisable to leave a number of trap logs in the middle of the clearings.

[581]. 45.3 : 12.25 : 13.2. **[Studies in biology and control of Engelmann Spruce**

bark beetle.] *Rep. Rocky Mt. For. Range Exp. Sta. 1946*, [1947?] (65–6).

Cf. *For. Abstr.* 9 (No. 396).

While the usual length of the life cycle of *Dendroctonus engelmanni* is 2 years, it may be one year during years with abnormally long growing seasons. Conversely, its maturity may be delayed to 3 years on cold sites and during cold years. The insects seem to need one winter in the adult stage before attacking green trees. Woodpeckers are by far the most important natural enemy, and increase in infested areas.

[582]. 45.3 : 12.25 : 13.2. Instruções sôbre a maneira de combater o 'bóstricos'. **[Instructions on means of controlling *Ips sexdentatus* Boern.]** Direcção Geral dos Serviços Florestais e Aqüícolas. Laboratório de Biologia Florestal, Lisboa. 1942. pp. 11. [Port.]

[583]. 45.3 : 12.25 : 13.2. **[Horntail-borer.]** *Rep. Cawthron Inst.* [1946] (31).

The rearing and distribution of the parasite *Rhyssa persuasoria*, which has been established against the horntail-borer of Pine trees (*Sirex noctilio*), has been maintained. Observations revealed a satisfactory control exercised by this parasite.

[584]. 45.3 : 12.25 : 13.2. CONNECTICUT. **Connecticut State Entomologist; forty-third report, 1943.** *Bull. Conn. agric. Exp. Sta.* No. 481, 1944 (234–324).

An account of the introduction and spread in North America of the sawfly *Diprion frutetorum*, with a description of its life and habits, natural and artificial control. The favoured food plants in New England are *Pinus resinosa*, *P. sylvestris* and *P. nigra* (pp. 307–13).

[585]. 45.3 : 12.25 : 13.2. CRIVELLARI, D. Osservazioni sulla raccolta dei nidi di processionaria del Pino (*Thaumatopoea pityocampa* Schiff.). **[Notes on the collection of nests of the Pine processionary moth (*T. pityocampa*).]** *Ital. for. mont.* 2 (2), 1947 (119–21). [It.]

Nests were systematically collected and destroyed each year from 1924 to 1946 in the state forest of Cecina, 390 ha. of almost pure Pine, surrounded by agricultural land and with no other Pine in the neighbourhood. The number of nests taken each year increased from 660 in 1926 to 24,959 in 1937. Since then each increase in the number taken in one year has been followed by a sharp regression in the following year or two years. It seems clear that this method of control is, by itself, quite insufficient, and may do as much harm as good, by destroying parasites and predators along with the nests of larvae.

[586]. 45.3 : 12.25 : 13.2 (76.6). FENTON, F. A., and AFANAŚIEV, M. **Seasonal cycle and control of the Pine tip moth.** *J. econ. Ent.* 39 (6), 1946 (818).

A brief report on biological and control studies of the Nantucket variety of the Pine tip moth (*Rhyacionia frustrana* Comst.) made at Stillwater, Oklahoma, in 1946. Four definite periods of moth emergence were observed during the year. An 0·48-per-cent. DDT spray gave very effective control if applied before the young larvae had reached the rapidly growing terminals. Where reinfestations in small blocks are possible, it is necessary to spray for each generation, but if large blocks can be sprayed and all infested trees treated in the immediate vicinity, one or two properly timed applications would appear to be sufficient to give protection.

[587]. 45.3 : 12.25 : 13.2. KONING, H. S. DE. Beschadigingen van naalden en knoppen van den zeeden (*Pinus pinaster* Ait.) door *Evetria sylvestrana* Curt. **[Damage to needles and buds of *Pinus pinaster* by *Evetria sylvestrana*].** *Ned. Boschb.-Tijdschr.* 17 (9), 1944 (262). [Du.]

[588]. 45.3 : 12.25 : 13.2 (79). KEEN, F. P. **Developments in forest insect control in the Pacific States during world war II.** U.S. Bureau of Entomology and Plant Quarantine, 1945. pp. 8 + 4.

Among the most noteworthy of the recent advances discussed is sanitation-salvage logging, by means of which high-risk trees are removed from the stand for the control of the Western Pine beetle (*Dendroctonus brevicornis* Lec.). A method of zoning Ponderosa Pine stands according to relative beetle hazards has been developed by the Bureau of Entomology and Plant Quarantine.

[589]. 45.3 : 12.25 : 13.2 (492) : 43.3. VOÛTE, A. D. Eenige gegevens inzake het optreden van voor bosschen schadelijke insecten

in verbrande grovedennenbosschen. [**Some data on the occurrence of insects injurious to forests in burnt Scots Pine woods.**] *Ned. Boschb.-Tijdschr.* 15 (12), 1942 (615–23). [Du.e.] [Biologisch Laboratorium 'Hoenderloo'.]

The beetles found in dying stems of *Pinus sylvestris* were: (*a*) under the thin bark—*Pityogenes bidentatus* (99 per cent. of the stems), *Pissodes piniphilus* (23 per cent.) and *Pissodes notatus* (very seldom found); (*b*) under the thick bark—*Myelophilus piniperda* and *M. minor*, *Pissodes pini*, and *Ips sexdentatus*. Larvae of longicorns were found in almost all trunks. No *Sirex* larvae were found. Collembola, mites, fly larvae, predators, etc., were not included in the study. The fauna of trees seriously injured by fire towards the end of April and examined 6 months later, agreed with that of trees dying from other causes. Fire-damaged trees were especially heavily infested by *Myelophilus*. Whether the lower part of a stem is attacked by *Myelophilus* and/or *Pissodes pini*, is decided by the time at which the tree becomes sufficiently weakened to attract these species. In view of their susceptibility to *Myelophilus*, trees seriously damaged by fire before Aug. 1st should be felled and completely barked to destroy the larvae and pupae. Barking should not be done before May 15th but should take place within 5 weeks of the occurrence of the fire.

[590]. 45.3 : 12.25 : 13.2 (492) : 13.15. BESEMER, A. F. H. Die Verbreitung und Regulierung der *Diprion pini*-Kalamität in den Niederlanden in den Jahren 1938–1941. [**The distribution and natural control of *Diprion pini* outbreaks in Holland in 1938–41.**] *Ned. Boschb.-Tijdschr.* 15 (4; 5; 6), 1942 (136–69; 198–241; 262–301). [G.du.]

D. pini is one of the worst pests of Scots Pine in Holland: on good sites damage from its attacks is less serious (few trees dying even after complete defoliation) than on poor ones, where the trees that survive are retarded in growth and liable to borer attack for several years. Most Scots Pine in Holland is on the poorer sites. *D. pini* has two generations a year in Holland: larvae of the spring generation pupate above ground, in the host tree or in heather, grass, etc., the adults emerging after about 14 days; those of the autumn generation pupate under the soil surface and adults emerge in the next or some following year. It has been found that the foci of outbreaks are all very similar, being places from or on to which sand has blown, with very poor vegetation (*Corynephorion*) and scattered groups of wind-sown Scots Pine—a site type designated as 'bent' by A. H. Verkuyl.

In forest on good sites the attacks of *D. pini* eventually lapse owing to the great destruction of cocoons and larvae by predators. From autumn to spring, especially in woods with abundant undergrowth, the mice *Apodemus s. sylvaticus* and *Evotomys g. glareolus* destroy large numbers of cocoons. Ants, especially *Formica rufa polyctena*, its var. *piniphila* and *F. pratensis*, carry off many full-grown larvae, especially those of the autumn generation, which are preparing to pupate. On the 'bent' sites, ants are practically absent and the mice make their runs only in the litter under the Pine trees; larvae pupating away from the trees, under lichens or among moss, may thus escape and give rise to an outbreak in the following year. The autumn generation is often swollen by the emergence in July of females which have undergone a long diapause (up to 3 years). The long diapause in the cocoon stage is an important factor in maintaining an outbreak, especially in the focal areas, serving as a reserve against bad years.

The egg parasite *Achrysocharella ruforum* is the most important parasite. It is capable of rapid multiplication, first in the *Diprion* foci and thence following, overtaking and suppressing the outbreak in its marginal portions. *A. ruforum* is, however, monophagous. Pupal parasites (ichneumonids and tachinids) were of far less importance in natural control.

For preventive control it would be best to eliminate the foci in the 'bent' areas completely; this, however, is not practicable, since the Scots Pine on the 'bent' plays an important part in sand fixation, and the removal of all such Pine is unjustifiable on aesthetic grounds. Broad belts of hardwoods round the 'bent' areas and on the better sites, or round Pine woods in the vicinity would afford considerable protection. Such barriers, where they existed, were observed to give good protection during the outbreaks studied.

Where a fresh outbreak occurs and there are few egg parasites, it should be worth while to introduce parasitized eggs from elsewhere to its marginal areas and centre. The author is

not hopeful about the possibilities of large-scale breeding of the egg parasite, nor of cold storage of parasitized eggs.

It is not yet possible to predict reliably the number of females to be expected from the pupae, and there are highly uncertain factors such as the migration of adults, destruction of cocoons by mice, etc., after samples have been collected. Observations on the sawfly eggs are only useful when made about a week before they hatch. For the present, better results are expected from regular inspection of forests liable to attack, and regular mapping of all the data obtained.

[591]. 45.3 : 12.25 : 13.2 (492). VOÛTE, A. D. De huidige plaag van de dennenbladwesp (*Diprion pini* L.) in Nederland. [**The present outbreak of *Diprion pini* in Holland.**] *Ned. Boschb.-Tijdschr.* 17 (9), 1944 (258–60). [Du.] [Biologisch Laboratorium 'Hoenderloo'.]

Severe and extensive damage was done by *D. pini* to Scots Pine in Holland in 1943. The development of the outbreak was similar to that of outbreaks in 1938–41 as reported by Besemer, attacks again spreading from definite foci represented by open, wind-disseminated Scots Pine on poor soils and by woods in which mice and red wood ants were absent or almost so. In most of the infested areas, the outbreaks were caused by sawflies immigrating from such foci, hence Thalenhorst's method of prediction by cocoon populations per unit area is by itself of no great value. Reliable prediction of outbreaks would involve regular study of larval populations in the foci, with investigations of egg parasitism if numbers appeared to be increasing rapidly. If egg parasitism reaches 70–80 per cent. there should be little fear of an outbreak; but where parasitism is low and eggs numerous enough to give expectation of serious defoliation in the focus, neighbouring woods should be searched for young larvae, and from the data obtained it should be possible to determine where to apply control measures.

No such accurate method of prognosis was possible in 1944, but the indications were that the outbreak would continue to spread. Owing to war-time difficulties there was little probability of adequate control by dusting.

[592]. 45.3 : 12.25 : 13.2 (492). FRANSEN, J. J. De bestrijding van de dennenbladwespplagen in Nederland gedurende de jaren 1938–1941. [**The control of outbreaks of *Diprion pini* in Holland in 1938–41.**] *Ned. Boschb.-Tijdschr.* 15 (11), 1942 (539–46). [Du.]

Preliminary laboratory experiments in 1937 indicated that: (i) Gypsum or 'dolomite marl' can be used as cheap substitutes for talc as a diluent for derris and pyrethrum preparations. (ii) Susceptibility to rotenone decreases as the larvae grow older, hence early dusting is important. (iii) By adding $\frac{1}{120}$–$\frac{1}{160}$ per cent. of pyrethrin to derris dusts, it is possible to kill larvae with dusts of very low rotenone content. The pyrethrin causes the colonies to disperse and increases the chance of contact with the dust; in addition the larvae fall to the ground, where they are exposed to many dangers. (iv) When dusts of low concentration are used, increases in rates of application give corresponding and initially rapid increases in mortality, but a limit is reached beyond which mortality can be further increased only if the rotenone content is raised. (v) Calcium cyanamide is a good substitute for derris, but only on sunny days.

In the subsequent successful field operations of 1938–41 most of the dusting was done by a power duster, though hand and rucksack dusters were used for low growth and in one case dusting was done by aeroplane. The dusts used consisted of gypsum or 'dolomite marl' with a rotenone content, varied with age of larvae, of $\frac{1}{16}$ to $\frac{1}{4}$ per cent., supplemented with $\frac{1}{160}$–$\frac{1}{130}$ per cent. of pyrethrin, or with a calcium cyanamide content of 12·5–50 per cent. similarly varied and similarly supplemented with pyrethrin. Where whole woods had to be dusted, rates of application of 50–100 kg./ha. were necessary, but where only margins were attacked the woods could often be saved by dusting these with comparatively small expenditure of materials. Dew, mist or drizzle are favourable, as the larvae are wetted and the dust adheres well and appears to act more efficiently. Low atmospheric humidity or heavy rain before or during dusting are unfavourable, but rain shortly after dusting is less disadvantageous than is generally believed, except in the case of calcium cyanamide dusts. Dusting of margins or in dense stands can be done in spite of strong wind.

Costs are considered and the results of the individual dusting operations are detailed. [Cf. *For. Abstr.* 9 (Nos. 567–8).]

[593]. 45.3 : 12.25 : 13.2 (43.1–5) : 13.15. SCHWERDTFEGER, F. Zur Kenntnis der Kiefernschonungsgespinstblattwespe (*Acantholyda erythrocephala* L.). [**Contribution to the knowledge of *Acantholyda erythrocephala* L.**] *Z. angew. Ent.* 28, 1942 (125–56). [G.g.]

Observations on the bionomics, ecology and control during an outbreak in 9- to 12-year-old stands of *Pinus sylvestris* in East Prussia. Dusting from an aeroplane with calcium ferro-arsenate (Hercynia Braun) gave an 85-per-cent. kill with 25 kg. per ha. and a 100-per-cent. kill with 50 kg. per ha.

[594]. 45.3 : 12:25 : 13.2 : 13.12 : 12.21. MÜLLER-KÖGLER, E. Laboratoriums- und Freilandsversuche mit Kiefernspannerraupen und zwei insektentötenden Pilzen. [**Laboratory and field experiments with larvae of *Bupalus piniarius* L. and two insect-destroying fungi.**] *Z. angew. Ent.* 28, 1942 (613–45). [G.g.] [Institut für Waldschutz der Preussischen Versuchsanstalt für Waldwirtschaft, Eberswalde.]

An investigation of the conditions needed for infection of caterpillars of *Bupalus piniarius* with *Spicaria farinosa* var. *verticilloides* and *Beauveria bassiana* and the effect of atmospheric conditions on the progress of the diseases. Specially high and specially low humidities favour the dying-off of infected larvae; in the first condition mortality is probably favoured by spore formation, in the second condition by reduced larval resistance. In the forest the average atmospheric humidity is about 60 per cent., and infection does not readily occur. Attempts to spread the diseases artificially need to be worked out carefully with reference to the effective zone of humidities.

Infection with *Spicaria* may occur at 0·5° C., and with both species of fungi at 8° C. up to 25° C.

[595]. 45.3 : 12.25 : 13.2 (43.1–5) : 13.15. HOFMANN, C. Beiträge zur Bionomie des veilgrauen Kiefernspanners, *Semiothisa liturata* Cl. [**Contributions to the bionomics of *Semiothisa liturata*.**] *Z. angew. Ent.* 28, 1942 (324–34). [G.g.] [Institut für angewandte Zoologie der Forstl. Forschungsanstalt München.]

New data on the bionomics of this species on *Pinus sylvestris* in Bavaria. One generation per annum is normal but a partial second is possible. It usually accompanies outbreaks of *Bupalus piniarius*.

[596]. 45.3 : 12.25 : 13.2 : 07.7. RICHMOND, H. A. **Western Hemlock looper, report on aeroplane spraying.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (1), 1947 (3–4).

Results of the application of DDT spray against the Western Hemlock looper [*Ellopia fiscellaria* var. *lugubrosa*] have now been analysed. A total of some 12,000 acres was sprayed during the week beginning July 25th. A high mortality of larvae occurred, the older and larger larvae being killed as readily as the smaller. The population continued to decrease for 10 days after spraying, but after that the residual population seemed to survive. The mortality in representative $\frac{1}{5}$-acre plots varied from 80 to 97 per cent. It was clear that in old infestations, natural control by parasites, etc., was simultaneously reducing the population. It is concluded that the successful use of aeroplane spraying requires an efficient and up-to-the-minute insect survey organization so that spraying may be done at a time when the greatest benefits will result. A safer and more practical method of application is essential in rugged mountain country such as that of British Columbia. The loss of life of those engaged in the work and the fire hazard to the forest in the case of a crash, are factors which must be given due consideration.

[597]. 45.3 : 12.26–8 : 13.2 (42.1-8). DONISTHORPE, H. **Additional host-plants of Coleoptera.** *Ent. mon. Mag.* 83 (992), 1947 (15).

Includes records of *Sinodendron cylindricum* on Cherry, and *Clytus arieties* and *Rhagium bifasciatum* on Hornbeam (*Carpinus betulus*).

[598]. 45.3 : 12.26–8 : 13.2 (492) : 13.15. FRANSEN, J. J. Een en ander omtrent de oecologie en de bestrijding van den bastaard-satijnvlinder. [**Notes on the ecology and control of *Euproctis chrysorrhoea*.**] *Ned. Boschb.-Tijdschr.* 15 (8), 1942 (349–67). [Du.]

From investigations of factors influencing the larvae in their colonial winter nests (temperature variations and mortality; site and food plant in relation to size and population of nests; natural enemies and number of larvae in nests; influence of temperature and of food plant on emergence from nests), it is concluded that the

relationships between the environment and the insect are too complex to be of use in prognosis.

An experiment on the possibilities of control by collecting nests between November and February, and leaving them on the ground (*a*) on a well drained S. slope,with low shrubs, (*b*) on a poorly drained N. slope with grass sward, showed that such treatment can considerably increase larval mortality. The earlier the treatment, the greater is the effect, e.g. mortality was almost complete in nests collected on Nov. 1st and placed on the poorly drained sward, and in such a case there should be little risk in dispensing with the normal procedure of burning. Later in the season, however, or on more permeable soils, this treatment would not be satisfactory.

[599]. 45.3 : 12.26–8 : 13.2 (71.4–8). SMITH, C. C. **Notes on the Birch shoot borer, *Epinotia solicitana* Walker (*Olethreutidae Lepidoptera*).** *Repr.* from *Acad. Nat.* 2 (6), 1946 (114–21). [Dominion Entomological Laboratory, Fredericton, N.B.]

Life history and injurious effects on White and Gray Birch in the Gaspé Peninsula in 1942–43.

[600]. 45.3 : 12.26–8 : 13.2. WALLACE, P. P. **Biology and control of the Dogwood borer, *Synanthedon scitula* Harris.** *Bull. Conn. agric. Exp. Sta.* No. 488, 1945 (373–95).

[601]. 45.3 : 12.26–8 : 13.2. A lagarta do sobreiro [*Lymantria dispar* L.) e outras lagartas que atacam os montados de sôbre. Indicações para a sua identificação e combate. **[The gypsy moth (*Lymantria dispar* L.) and other larvae attacking Cork Oak groves. Directions for their identification and control.]** *Sep.* from *Bol. Junta nac. Cortiça, Lisboa.* No. 93, 1946. pp. 14. [Port.]

[602]. 45.3 : 12.26–8 : 13.2 (86). RODRIGUEZ, L. Una plaga de los Eucaliptos. **[A pest of Eucalypts.]** *Bol. Inst. bot. Univ. Ecuador* No. 5, 1945 (117–22 + plate). [Span.] A.P.B.

A general account of *Parâmallocera ilinizae* Kirsch. which is believed to have spread to Eucalypts in Ecuador from *Prunus capollin* cultivated in the vicinity.

[603]. 45.3 : 12.29 : 13.2. ALIBERT, H. Étude sur deux insectes parasites des noix de palme en Afrique occidentale. **[Study of two insects parasitic on *Elaeis guineensis* in West Africa.]** *Agron. trop.* 1 (3/4), 1946 (173–6). [F.] E.M.B.

Description, distribution, damage and control of *Pachymerus lacerdae* and *Coccotrypes congonus.*

[604]. 45.3 : 41 : 07.7. **Forests and the helicopter.** *Timber of Canada* 7 (6), 1947 (64–6).

A short account of tests of helicopter model 47B-3 by the Bell Aircraft Co., in dusting and spraying orchard and forest trees.

[605]. 45.3 : 91.1 : 07.7. **Forest spraying and some effects of DDT.** *Res. Rep. Ont. Dep. Lds. For.* No. 8, 1946. pp. 105 + dgms.

This report covers the continuation during 1945 of studies on aerial spraying of insecticides in Algonquin Park and on an area of 100 sq. miles in the Port Arthur region. [For an earlier report on operations in 1944, see *For. Abstr.* 7 (No. 2078).] It contains the following reports. (1) *Lake Nipigon Spray Operation* (cf. *For. Abstr.* 7 (No. 2062). (2) *The effect of DDT on freshwater fishes* (giving substantially similar findings to those in the earlier report). (3) *Application of DDT in control of Spruce budworm, Lake Nipigon area—1945.* Technical details of the composition of the spray solutions, type of aircraft used, process of application, etc. (4) *Special Report on effect of DDT on bird and mammal populations in the Spruce/Fir forest of Canada, April-July, 1945.* Application of DDT in an oil spray at rates of 1, 3, and 5 lb. per acre early in May, on small areas of Spruce/Fir forest, produced no apparent harmful effect on the birds that were present. An application of DDT in an oil spray at the rate of 1 lb. per acre in late May and June, over an extensive area of Spruce/Fir forest, which caused an insect kill of 50–60 per cent., produced a small, perhaps negligible, direct mortality of birds, but did not affect the size of the total breeding bird population nor the success in raising of young. No effect was produced on the resident mammal population.

47. INJURIES OF ALL KINDS TO INDIVIDUAL TREE SPECIES

See also *For. Abstr.* 9 (No. 186).

[606]. 47 : 12.25 : 54 : 57 : 24 (47.1). TIKKA, P. S. Puiden vikanaisuuksien merkitys ja huomioon ottaminen Perä-Pohjolan mäntymetsien hoidossa. [[**A mensurational study of] tree injuries: their significance in the silviculture of north Finnish Pine forests [and reduction by proper tending**].] *Acta forestalia fennica* 50 (1), 1940 (1942). pp. 91. [Fi.g.]

[607]. 47 : 12.26–8 (71.5 : 71.6 : 71.7). BARTER, G. W. **The dying of Birch.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (1), 1947 (1).

A summary of what is known about the degree of damage in the Maritime Provinces to date.

[608]. 47 : 12.26–8 : 56 : 21.8 : 45.3' FRANSEN, J. J., and HOUTZAGERS, G. Aanwasverliezen als gevolg van kaalvreterij en groeirythme bij populieren. [**Loss of increment as a result of defoliation, and the seasonal growth of Poplars.**] *Ned. Boschb.-Tijdschr.* 18 (2), 1946 (36–9). [Du.]

Small-scale experiments on the effect of artificial defoliation in June on the growth of young trees of × *Populus serotina* and × *P. marilandica*, showed that the annual increment of both hybrids was reduced by about one-half as compared with controls, whether on the basis of weight or sectional area.

Observations from 1940 to 1943 on the seasonal growth of a limited number of trees of *P. deltoides* var. *missouriensis* suggest that the major part of the diameter increment occurs before Aug. 1st and that maximum diameter growth occurs in May. Thus any defoliation during early summer is especially injurious as regards diameter growth.

[609]. 47 : 12.26–8 : 12.14.5 : 12.11.2 : 45.3. WALLACE, P. P. **Certain effects of defoliation of deciduous trees.** *Bull. Conn. agric. Exp. Sta.* No. 488, 1945 (358–73).

Ulmus americana was used in studies on the effects of defoliation. Treatments consisted of (*a*) one complete defoliation in early June, and (*b*) the same and a second in mid-July. Terminal dieback was greatest after treatment (*b*); but after two successive years of treatment, the trees appeared to be in fair condition and only one had died. The mean twig length of trees defoliated once was slightly greater, that of trees defoliated twice considerably less, than that of controls. Diameter increment for both groups of defoliated trees was about one-fourth that of the controls. The number of leaves per tree produced after one defoliation was significantly less than that of the controls. The final number on twice-defoliated trees was about the same as that on the controls, but defoliations successively reduced the mean size of the leaves as well as the mean tree leaf area. The date of flushing in the following year was delayed by one defoliation and further delayed by two defoliations. Buds on the shoots formed after defoliation were smaller than normal. Defoliated trees were more susceptible to Dutch Elm disease than normal trees [cf. *For. Abstr.* 7 (No. 946)], but were not specially susceptible to bark-beetle attack.

Tests made on seedlings gave rather contradictory results. There was a wide variation in the increase of weight and total shoot length within treatments, but the mean measurements suggested no differences between the treatments, except that the control plants made slightly less gain in both weight and length growth than did either of the other two treatments. This suggests that young plants may respond to treatment very differently from large trees of the same species and that there is great variation in the response among individual plants which appear externally alike.

5. MENSURATION. INCREMENT. YIELD

51. WEIGHTS AND MEASURES

[610]. 51 : 52.43.2. **Conversion tables for timber: cubic metres, cubic feet and standards.** *Timb. Inform. Timb. Devel. Ass.* Ref. No. 30, 1947. p. 1.

52. MEASUREMENT OF TREES AND TIMBER

52.1. *Diameter. Girth. Sectional Area*

[611]. 52.1 : 52.43.5 : 01.7. STOFFELS, A.

De berekening van de middelbare afrondingsfout in de totale cirkelvlakte van proefvakken. [**The calculation of the standard error due to rounding-off [of diameter measurements] in the total basal area of sample plots.**] *Ned. Boschb.-Tijdschr.* 14 (5), 1941 (210–4). [Du.g.]

If σ_σ is the standard error due to the rounding-off of diameter measurements, and G is the sum of the basal areas, then $\sigma_G = f\sqrt{G}$, where f is a constant depending on the diameter interval used. A table is given of values of f and log f for diameter intervals between 0·1 and 10·0 cm.

52.2. *Height. Length*

[612]. 52.2 : 07.7. JURRIAANSE, A. E. Hoogtemeter. [**A hypsometer.**] *Ned. Boschb.-Tijdschr.* 14 (1), 1941 (22–4). [Du.]

Description, with diagrams, of a hypsometer of the same general type as Winckler's or Smythies', but mounted on a stick and lacking a protractor scale, distance to the tree being measured by a tape. The tape box is mounted near the bottom of the stick and is readily detachable for general use if required.

[613]. 52.2 : 07.7. STOFFELS, A. De nauwkeurigheid van metingen met den hoogtemeter van Weise. [**The accuracy of measurements with Weise's hypsometer.**] *Ned. Boschb.-Tijdschr.* 17 (7), 1944 (201–5). [Du.f.]

When Weise's hypsometer is used on level ground, the standard error of the height readings will be at a minimum when the observer's distance from the tree is equal to its height. In 137 observations by 4 persons on trees of different heights, the standard error of the angle of observation was 0·0177. A table is given of the errors in metres obtained for trees of different heights and at varying distances of the observer from the tree.

[614]. 52.2 : 07.7. KONING, H. S. DE. Fouten bij metingen met den hoogtemeter van Weise. [**Errors in measurements with Weise's hypsometer.**] *Ned. Boschb.-Tijdschr.* 17 (9), 1944 (256–7). [Du.]

Cf. preceding abstract. Weise's hypsometer is awkward to handle at short distances from the object to be measured and the observer usually selects a distance greater than the tree height. A longer base line is also desirable in measuring trees with broad crowns, as with a short base line the actual top may lie in 'dead ground'. Leaning stems can give varying readings from different positions of the observer even when the lean is not apparent to the eye.

52.4. *Measurement of Volume*

[615]. 52.4. ROUSSEL, L. La dendrométrie. [**Tree measurement.**] *Bull. Soc. for. Franche-Comté* 24 (16), 1947 (9–17). [F.]

The writer points out the deficiencies in point of accuracy of the current commercial methods of measuring tree volume for individual trees and for whole stands, and suggests that better results might be obtained by a geometrical method of volume estimation, i.e. by regarding the bole of a tree as one of 4 regular solids (cylinder, paraboloid, cone, neiloid).

[616]. 52.43.2 (44) : 32.81. Bois: cubage des grumes d'œuvre. [**Wood: mensuration of logs.**] *Norme franç.* No. NF B53–015, 1945. pp. 8. [F.] Association française de normalisation, 23, rue Notre-Dame-des-Victoires, Paris 2e. B.S.I.

[617]. 52.43.2 (492). STOFFELS, A. Eenzijdige fouten bij het inhoudsbepaling van stammen volgens de I.M.E.S.-voorschriften. [**Systematic errors in the scaling of logs under the I.M.E.S. regulations.**] *Ned. Boschb.-Tijdschr.* 18 (2), 1946 (30–2). [Du.]

[618]. 52.43.3 : 12.25 : 12.26–8 (485) : 01.7. NÄSLUND, M. Funktioner och tabeller för kubering av stående träd: tall, gran och björk i södra Sverige samt i hela landet. [**Empirical formulae and tables for determining the volume of standing trees: Scots Pine, Norway Spruce and Birch in southern Sweden and in the whole of the country.**] *Medd. SkogsforsknInst., Stockh.* 36 (3), 1947. pp. 81. [Sw.e.]

In extension of a previous paper on the material and results for the same species in Norrland [see *For. Abstr.* 4 (62)], Näslund here deals with the southern Swedish material and —mainly with a view to use in the transition zone—with that for the country as a whole. Six chapters give an account of the material and method used, the computation of the formulae for Southern Sweden, their accuracy, the formulae for the country as a whole, and

the practical use of the formulae. Volume tables are appended for each species in each of the regional groupings. There is a 12-page English summary.

[619]. 52.43.3 : 12.25–8 (73). MESAVAGE, C., and GIRARD, J. W. **Tables for estimating board-foot volume of timber.** U.S Forest Service. 1946. pp. 94.

These tables have been compiled for use in estimating the board-foot contents of United States eastern hardwoods and southern hardwoods and softwoods. Separate tables are given for the International ¼-inch log rule, the Scribner log rule, and the Doyle log rule.

[620]. 52.43.4. STOFFELS, A. De berekening van den inhoud van opstanden door meting van een enkelen modelboom. **[The calculation of stand volume from measurements of a single sample tree.]** *Ned. Boschb.-Tijdschr.* 15 (9), 1942 (399–408). [Du.g.]

Neubauer's method (which is to calculate from volume tables the diameter of the tree of mean volume, measure the volume of a sample tree with that diameter, and obtain stand volume by multiplying that of the sample tree by number of stems) is shown to give correct results in theory only under certain specified conditions. The method is, however, a considerable advance on the earlier one in which it is assumed that the tree of mean basal area is also the tree of mean stem volume.

[621]. 52.43.4 (485) : 32.1 : 35. NYBLOM, E. Mätning och taxering av rotposter. **[Measurement of timber for sale on the stump.]** *Skogen* 34 (6), 1947 (95–9). [Sw.]

The text is given of proposals put forward by a committee of the County Foresters' Association for uniform procedure in measuring standing timber for sale, and already accepted as rules by many of the County Forestry Boards in Sweden.

[622]. 52.43.5 : 07.7. UBBINK, W. H. Nieuwe methode voor het uitzetten van proefvlakken. **[A new method of setting out [circular] sample plots.]** *Ned. Boschb.-Tijdschr.* 19 (3), 1947 (83–4). [Du.]

An instrument devised by J. A. Løvengreen for setting out circular sample plots consists essentially of two mirrors facing each other but mounted about 4½° out of parallel, and is attached by a screw to an ordinary caliper. A light ray entering the instrument emerges with an angular difference equal to twice the deviation of the mirrors from parallel (i.e. about 9°). In the centre of the sample plot is placed a stake carrying two conspicuous markings (movable cylinders) spaced at such a distance that when viewed from the desired radius, directly with one eye and through the instrument with the other, they exactly coincide. It is thus very simple to check, in case of doubt, whether a given point is within the required radius or not. Ten sample plots of 5 ares (radius 12·62 m.) can easily be measured in an hour.

52.46. Strip Surveys. Enumerations. Timber Cruising

[623]. 52.46 (54). GRIFFITH, A. L. **The efficiency of enumerations.** *Indian For.* 73 (3), 1947 (102–7). [Forest Research Institute, Dehra Dun.] (7th Silvicultural Conference, Dehra Dun, 1946.)

Cf. *For. Abstr.* 7 (Nos. 1432, 2090–2), 8 (Nos. 739–40, 2151).

[624]. 52.46 : 01.7 : 52.43. MATÉRN, B. Metoder att uppskatta noggrannheten vid linje- och provytetaxering. **[Methods of estimating the accuracy of line and sample-plot surveys.]** *Medd. Skogsforskn-Inst., Stockh.* 36 (1), 1947. pp. 138. [Sw.e.]

The chief aim of this paper is to provide, for systematically designed surveys, a mathematical model sufficiently accurate to serve as a basis for the estimation of error. Formulae for calculating the standard error of a regularly spaced line survey are examined with the aid of a mathematical model derived from an extension of the theory of 'stationary stochastic processes', and it is shown that the most suitable formulae are based on expressions of the variation between fairly short, closely spaced strips. The application of a formula of this kind, which can also be used for estimates based on a regularly designed sample-plot survey or on sample-tree measurements, is illustrated by numerical examples. In connexion with a discussion of the accuracy of double sampling, a method is suggested for increasing the precision of results by the aid of maps.

Three chapters are devoted to the fundamental mathematical problem involved, and four more

to practical applications. There is an extended summary in English (19 pp.) and about 70 references to literature.

53. SOLID CONTENTS OF STACKED MATERIALS. REDUCING FACTORS

See also *For. Abstr.* 9 (No. 340).

[625]. 53 : 52.3 : 12.25. WUOTI, E. Kuusisahapuun teknillisen ja pinokuution välinen suhde sekä sen riippuvaisuus muotoluokasta. **[The relation of 'technical' to stacked volume in Spruce sawtimber and its dependence on stem form.]** *Acta forestalia fennica* 50 (18), 1942. pp. 40. [Fi.g.]

54. FACTORS CONNECTED WITH ASSORTMENT

[626]. 54 : 33.53 : 12.25. HAWES, E. T. **A method of determining Southern Pine pole classes from d.b.h.** *J. For.* 45 (3), 1947 (204–5).

The author has constructed a table from which it is possible to grade Southern Pine in pole classes (according to the American Standard) by a simple measurement of d.b.h. The table is based on the formula d.b.h. =

$$\frac{\textit{Minimum circumference at 6 ft. from butt}}{0{\cdot}88 \times 3{\cdot}1416}$$

which assumes a ratio of 0·88 between d.b.h. and d.i.b. at 6 ft. from butt. If the table proves unsuitable for local taper and bark conditions, a suitable table may be made by substituting the proper ratio in the above formula.

56. INCREMENT

See also *For. Abstr.* 9 (Nos. 110, 194, 209, 330, 608–9, 644–6).

[627]. 56 : 12.25 (52) : 57 : 12.19. KOOLS, J. F. Eenige aanvullingen op 'Een en ander betreffende den groei van jonge lariks opstanden (Jap. lariks)'. **[A few data supplementary to 'Notes on the growth of young Japanese Larch stands'.]** *Ned. Boschb.-Tijdschr.* 19 (3), 1947 (81–2). [Du.]

Brief quotations of captions to photographs of Japanese Larch woods in a Japanese work issued to commemorate the 50th anniversary of the Forest Service in 1936, with a note on the natural distribution of this species. Cf. *For. Abstr.* 8 (No. 2154).

[628]. 56 : 12.25 : 22.83 (47.1) : 21.0. LAPPI-SEPPÄLÄ, M. Siperian lehtikuusen kasvusta sekametsiköissä evon valtionpuistossa. **[The increment of Siberian Larch in the mixed stands of the Evo State Forest, [Finland].]** *Acta forestalia fennica* 50 (8), 1942. pp. 19. [Fi.g.]

[629]. 56 : 21.6 : 12.25 : 24.2. BADOUX, E. Relations entre le développement de la cime et l'accroissement chez le pin sylvestre. **[Relations between crown development and increment in *Pinus sylvestris*.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (2), 1946 (405–516). [F.f.g.]

This paper examines the relations, in Swiss stands of *Pinus sylvestris* of different provenance, constitution and composition, between current increment on the one hand and crown cover, crown volume, crown surface area, weight of branchlets and needles, and needle weight, on the other. The current increment of upper-storey trees was found to bear no direct relation to either total crown volume or volume of the needle-bearing crown, but was in almost direct proportion to the external surface area of the crown, which carries the greatest and most active portion of the total needle mass. For dominants and co-dominants there was also often a close correlation between increment and crown cover. In general, total weight of branchlets and needles was a less reliable index to the increment capacity of a tree than was the surface area of the crown. The relation between increment and needle weight varied less widely than that between increment and crown volume. The crown of Pine is neither very large nor very heavy as compared with that of Spruce, Silver Fir or Beech as investigated by Burger: the average Pine of 36 cm. d.b.h., in the material studied, had a crown volume of 54–124 cu.m., its branchlets and needles weighing 111–181 kg. The fresh needle weight required to produce 1 cu.m. of *Derbholz* (timber over 7 cm. diam. at the small end) annually is 850 to 1,500 kg., the yield decreasing rather regularly with age from 38 to 107 years and varying from race to race, an unfavourable ratio being noted for the Northern European races.

The important practical point which emerges from this study is that in *P. sylvestris* increment is determined by crown surfaces, viz. the well illuminated lateral and horizontal surfaces of the crown, and not by the occupation by foliage

of the space between the ground and the top of the crown. The sum of such well illuminated surfaces per unit area cannot be greatly altered by silvicultural treatment, provided that canopy is not definitely broken, thus different thinning grades can have little effect on current volume increment: a closed stand of a given race in a given locality will yield approximately the same volume in a given period whether there are few or many stems per unit area. The important task of the silviculturist is therefore to see that this roughly constant increment accrues on a relatively small number of stems subjected to increasingly severe qualitative selection.

[630]. 56 : 22.15. LONG, H. D. **A proposed method of estimating the growth of pulpwood stands.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 880 (F–2), 1947. pp. 8. [Pulp and Paper Research Institute of Canada, Montreal.]

The proposed theory of stand growth is, that closed stands (i.e. stands fully utilizing the site) have a constant net volume increment per unit of height increment, regardless of the basal area or average height of the stand. This relation may be expressed by the equation VI = K.HI, where VI is the net volume increment in cubic feet, HI is the average height increment of the stand and K is a constant more or less fixed for a given species. The application of this theory to growth estimation is discussed and the limitations and advantages of the method are pointed out. The theory needs confirmation from further research, but appears to give good correlation when applied to yield-table data. *From author's summary.*

[631]. 56 : 22.83.2 : 57. BUELL, J. H. **The prediction of growth in uneven-aged timber stands on the basis of diameter distributions.** *Bull. Duke Univ. Sch. For.* No. 11, 1945. pp. 70.

This bulletin presents a method of estimating growth of uneven-aged timber from the diameter distribution of the stand, without the necessity of making increment borings. The basic data were obtained from remeasurements of permanent sample plots. For the data used (mixed stands in the southern Appalachians), all species may be thrown together in making estimates of net growth, since within types all species grow at much the same rate, though different types grow at different rates. Differences between types are less in older than in younger stands. The combining of species reduced the number of independent variables in the growth equations from 12 to 3. Differences between the 3-variable regressions for different types in old-growth stands were not statistically significant, so that one equation could be used for all old-growth stands. In second-growth stands regressions for the four types differed significantly. The total number of 3-variable growth equations finally needed was therefore 5. From the 5 growth equations used, the contribution of trees of each diameter class to the net growth, mortality, etc., of the stand was estimated. These estimates can be used as guides in drawing up timber-marking rules. In order to maintain the rate of growth of a forest, cutting can be confined to diameter classes with negative growth, and made heaviest in stands in which expected mortality is greatest.

A set of growth tables is presented as an illustration of the practical application of this method of predicting growth. Given a diameter tally of a stand, it is as easy to compute its expected current growth from these tables as it would be to compute its basal-area from a basal-area table. *From author's summary.*

[632]. 56 : 12.25 (77.4) : 22.15 : 23.1 : 64 : 42.1 : 32.2. BOWMAN, A. B. **Growth and occurrence of Spruce and Fir on pulpwood lands in Northern Michigan.** *Tech. Bull. Mich. agric. Exp. Sta.* No. 188, 1944. pp. 82.

The objects of this study, which was initiated in 1933, were (1) to devise methods useful in determining site qualities of land bearing pulpwood stands of various types; (2) to compile growth tables and show how they could be used in predicting future yields of various types of stand; (3) to determine the rate of diameter and height growth of the different species occurring on pulpwood lands; (4) to observe changes in stand composition as a result of cutting; (5) to acquire information on losses due to logging, wind, insects and disease; (6) to note conditions favourable or unfavourable to the establishment of reproduction.

Site quality, diameter, and height growth were separately calculated and are presented in tables, for the even-aged, uneven-aged, overtopped, and cut-over stands. Site qualities for even-aged stands were found by the use of age-height relationships of dominant trees on

a site-index chart. For the other kinds of stand, the soil type method is recommended.

The volume growth of fully stocked, even-aged stands is very irregular. On fair to good sites, young stands, 30–40 years of age, might produce more than 1 cord per acre per year, decreasing to little more than 0·1 cord as the stand approaches 100 years of age. The highest average annual growth is obtained when stands reach 60 years of age, and even-aged stands might well be cut at this age, especially if they contain a large proportion of Balsam Fir, which deteriorates very rapidly. Uneven-aged stands grow much more uniformly from year to year; fully stocked stands on good sites may grow as much as 1 cord per acre per year for limited periods; on poor sites the growth would not exceed 0·5 cord. Over-topped stands of Spruce and Fir are usually found on the better soils. Growth of the understorey is slowed up considerably when the overstorey is dense (75–100 per cent.), but not very much where the overstorey is moderate (50–75 per cent.). A fairly well stocked understorey of Spruce and Fir on a fair site may produce from 0·5 to 0·7 cord of pulpwood per acre per year under a moderate canopy. Under a full canopy the growth would be less than 0·4 cord.

Cut-over stands that have been burned over after logging generally revert to Aspen. Aspen outgrows and generally outnumbers all other common species found on Spruce/Fir cut-over lands. Spruce and Fir grow very slowly in youth and therefore suffer various degrees of suppression from Aspen and other hardwoods; if liberated, however, they respond with height and diameter growth second only to Aspen. One of the main problems in providing for a succeeding stand of Spruce and Fir is their susceptibility to windthrow. Losses from this cause generally range between 40 and 70 per cent. of the residual volume in heavily cut stands and may approach 100 per cent. in some.

The most important factors affecting the kind and quantity of reproduction following cutting are: fire, proximity of seed trees, seed-bed conditions, degree of cutting, vegetative cover, logging damage, and slash. Reproduction of pulpwood species is generally adequate on cut-over areas if fire is excluded, otherwise it is sparse or non-existent. Spruce and Fir prefer a mineral seedbed to one of duff for regeneration in quantity, but as Aspen also prefers it, they do not gain control of such sites, but have a better chance where there is moderate shade over a duff layer: such conditions result from light or moderate cutting. Heavy cutting destroys much of the advance reproduction. Even where it is carefully done, 15–20 per cent. of the reproduction is lost. Lack of slash disposal on most logging operations frequently leaves the area unproductive for 15–20 years.

[633]. 56.02 : 11.21. DOUGLASS, A. E. **Precision of ring dating in tree-ring chronologies.** *Univ. Ariz. Bull.* 17 (3), 1946. pp. 21.

A discussion of the essential factors in attaining precision in the dating of tree rings, i.e. site classification of trees, proper surfacing of specimens, crossdating to correct ring errors and determine climatic effects.

[Cf. *For. Abstr.* 9 (Nos. 17, 47).]

[634]. 56.02 : 12.19.2 (729.5) : 21.6. WADSWORTH, F. H. **Growth in the lower montane rain forest of Puerto Rico.** *Carib. For.* 8 (1), 1947 (27–43). [E.Span.f.]

The Puerto Rico Forest Service has, since 1935, been collecting growth data for the lower montane rain forest, by measuring and re-measuring marked trees, and some preliminary conclusions can now be drawn. Measurement of nearly 1,000 trees, on a plot of 1·8 acres, showed that diameter growth is very slow. The principal factor responsible is competition between individuals. Eighty-two per cent. of the trees are in the intermediate and suppressed classes. The mean annual diameter growth of dominants over a period of 3 years was 0·25 in.; that of intermediate and suppressed trees was only 0·08 in. Silvicultural treatment should be directed towards the removal of old, sickly and undesirable dominants in order to encourage the growth of young, better-quality suppressed trees.

[635]. 56.02 : 12.26–8 : 12.12. NATIVIDADE, J. VIEIRA. Sôbre as anomalias do crescimento radial do tronco da oliveira—*Olea europaea* L. **[On anomalies of radial growth in the trunk of *Olea europaea*.]** *Agron. lusitana* 6 (4), 1944 (349–66 + plates). [Port.]

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

See also *For. Abstr.* 9 (Nos. 193, 196, 206, 209, 255).

[636]. 57 : 12.26–8 (492) : .56. TUTEIN NOLTHENIUS, P. M. Groei en aanwasbepaling van een 63-jarigen eikenopstand in de Boschwachterij 'Ulvenhoutschbosch'. [**Growth and determination of increment of a 63-year-old Oak stand in the Boschwachterij of 'Ulvenhoutschbosch'.**] *Ned. Boschb.-Tijdschr.* 17 (8), 1944 (225–7). [Du.]

The results of stem analysis of three trees (as close as possible to the mean tree) are shown graphically and compared in a table with figures for Schwappach's quality classes I and II, between which they lie. At 63 years of age the mean height was 19 m., with a diameter of 22 cm., a form factor of 0·47, and a stem volume per ha. of 196 cu.m. over, or 166 cu.m. under, bark. Between 60 and 63 years of age the annual increment per cent. was still 2·68, and from that of the preceding 5-year period (3·76) it is inferred that the increment would have been higher in the last four years but for attacks in 1942 by *Geometra brumata* and *Tortrix viridana*.

[637]. 57 : 12.26–8 (729.5). PUERTO RICO. **Stand studies.** *Rep. U.S. trop. For. Exp. Sta. 1946*, 1947 (22).

Yield from an 8-year-old Mangrove forest, cut to 3-in. diameter limit, was 3,452 posts of 2–3 in. top diameter and 10 cords of fuelwood, total stumpage value $183.00 per acre, or $23.00 per acre per year. Yield from a 10-year-old plantation of *Casuarina equisetifolia* averaged 3·12 cords per acre per year. On favourable sites this species attains a diameter of 9·5 in. in 10 years and 15 in. in 20 years. Coppice stands of *Eugenia jambos*, when clear cut, yielded 20–25 cords per acre on an 8-year rotation, or 2·5–3 cords per acre per year.

[638]. 57.4 : 07.6. SOEST, J. VAN. Over den aanleg, het opmeten en de behandeling van proefvelden in den boschbouw. [**The establishment, measurement and treatment of [permanent] sample plots.**] *Ned. Boschb.-Tijdschr.* 17 (3; 4), 1944 (79–85; 123–33). [Du.]

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

[639]. 60.31.2 (43.6). GLOVER, SIR H. **Private forest estates in the British zone of Austria (1946).** *Forestry* 20, 1947 (44–51 + plates).

[640]. 60.31 : 22.83.2 (73). REYNOLDS, R. R. **Management of second-growth Shortleaf-Loblolly Pine-hardwood stands.** *J. For.* 45 (3), 1947 (181–7).

The author outlines the steps to be taken in bringing under management an imaginary estate of 20,000 acres of second-growth mixed timber, not previously managed, which is to be managed for maximum production of good sawtimber with some poles, piling and pulpwood from thinnings. Subjects dealt with include determination of growing stock and growth rate, cutting cycles, division into compartments, and determination of allowable cut.

61. SURVEYING. MAPPING

See also *For. Abstr.* 9 (Nos. 5–6).

[641]. 61. **Elementary map and aerial photograph reading.** *Field Manual U.S. War Dep.* No. FM 21–25, 1944. pp. 116.

[642]. 61. **Advanced map and aerial photograph reading.** *Field Manual U.S. War Dep.* No. FM 21–26, 1944. pp. v + 141.

[643]. 61.32 (71.5). BROWN, K. B. **Miramichi survey.** *Rep. New Brunsw. Dep. Lds. Min. 1946*, 1947 (53–7).

Aerial photographs obtained in 1944 and 1945 made possible a reconnaissance survey of the forests of the Miramichi basin, the forest resources of which, since a severe budworm attack 25 years ago, were much debated. Work was done previously from photographs, with some ground checking, and estimates were compiled for the whole 3½ million acres of the main catchment area, and for 30 minor catchments. Conditions were classified in 7 groups: (1) stands ready for immediate exploitation, (2) stands which should not be exploited immediately, being thrifty and capable of further improvement, (3) mature or stagnating stands, (4) young growth, (5) potentially

productive forest land with less than 5 per cent. cover as a result of fire, clear felling, etc., (6) areas which have apparently never carried forest, (7) cleared land, towns, etc.

Estimated figures are given together with notes on the methods employed in obtaining them.

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

See also *For. Abstr.* 9 (Nos. 17, 77, 632).

[644]. 64 : 12.25 : 11.49.5 (410) : 23.3 : 23.52 : 11.47.2. GALE, B. **Observations from the Isle of Man: tree growth on moorland soils.** *Quart. J. For.* 41 (1), 1947 (17–19).

On the more intractable moorland soils it seems necessary to establish forest soil conditions before tree growth is possible. Some observations have been made on varying growth under different conditions. On the less exposed sites, on moorland soil, all species appear to remain checked for 20–25 years, and thereafter show a remarkable acceleration in the rate of growth. Curves based on the stem analysis of an average Larch illustrate this. It appears from the age-height curve that at 20 years it was 5 ft. below quality class V, while at 60 years it is 4–6 ft. above and the tendency of the curve indicates that at 80 years it might reach quality class IV. On the most exposed sites, at 900–1,200 ft. above sea level, it appears that the primary check remains permanent, the trees degenerating to 10–15 ft. scrub. On both sites the soil changes are similar, namely from a hard heathery moorland soil, devoid of life, to an open active soil containing a fair number of worms and fungal life with a sufficiency of humus. About 2 acres of this scrub was planted with various species (chiefly Sitka Spruce) at 9 × 6 ft. with the minimum of clearing in 1936. These are now topping the scrub at 20–25 ft. and show no signs of exposure. Clear felling of these areas and replanting, on the other hand, results in reversion to moorland with the 10–20 years check repeated. It is suggested that the employment, on such sites, of a pilot crop of e.g. Mountain Pine, White Beam, Rhododendron and Laurel, 5–10 years before the introduction of the main crop would prevent the latter from suffering check.

[645]. 64 : 12.25 (42.9) : 11.3 : 11.41.8 : 01.7. DAY, W. R. **On the effect of changes in elevation, aspect, slope, and depth of free-rooting material on the growth of European Larch, Japanese Larch, Sitka Spruce, and Scots Pine in Mynydd Ddu Forest.** *Forestry* 20, 1947 (7–20).

It has been shown by the analysis of suitably collected data that where the rooting profile of trees encounters some restricting layer in the subsoil, such as clay or hard rock, so that the major part of the root development necessarily takes place above this layer, there is a correlation between depth of free-rooting material within the soil profile and the height quality of the forest crop (i.e. total height at 50 years of age). In the present study an attempt is made to isolate the effect of depth of free-rooting material, and of elevation, aspect, and slope of ground, on the height growth of the trees, by means of correlation analysis. The total correlations derived from the data for European and Japanese Larch in Mynydd Ddu Forest are set out in one set of tables and those for Sitka Spruce and Scots Pine in another. The partial correlation coefficients for mean height with the edaphic and the three topographical factors are set out in further tables and the related partial regression coefficients are also given. These give the change to be observed in mean height with unit change in the value of the correlated factor. The partial correlation coefficients for European Larch reveal a significant positive correlation between depth of free-rooting material and mean height, and significant negative correlations between elevation and slope and mean height, whereas the total correlation with depth of free-rooting material was insignificant; also all the significant partial correlations are higher than the corresponding total correlations. In the case of Japanese Larch, significant partial correlations are obtained between mean height and depth of free-rooting material and elevation, their value in each case being higher than those of the corresponding total correlation; the significant negative total correlation with slope, on the other hand, has been changed into a lower and insignificant partial correlation. Similar differences were revealed between total and partial correlation coefficients for Sitka Spruce and Scots Pine. It is concluded that problems of fundamental silvicultural research must be answered increasingly by means of mathematical analysis of quantitatively measurable data.

[646]. 64 : 12.25 : 11.49.3 (77.3) : 56. LORENZ, R. W., and SPAETH, J. N. **The growth of conifers on prairie soils.** *J. For.* 45 (4), 1947 (253–6). [Dept. of Forestry, University of Illinois, Urbana, Ill.]

In 1871–72, six coniferous and 18 deciduous tree species were planted on heavy prairie soil at the University of Illinois. Growth data are presented for *Pinus strobus*, *P. sylvestris*, *Larix decidua* and *Picea abies*. Planted trees grew very rapidly for the first 25–30 years and most heights were well above the average for Site I, but from 30 years onwards height growth in all cases fell below that of normal plantations on which the site indexes were based, and at age 70 their site indexes approximate to, or are even below, the lowest standard site index. Latitude is the primary climatic factor at Urbana. Weather statistics from 1888 show minimum and maximum temperatures of 25° F. and 108° F. respectively. Average annual precipitation is about 36 in. The average dates for the last killing frost in spring and the first killing frost in autumn are April 25th and October 15th respectively, leaving 180 frost-free growing days. The data, which are presented graphically, illustrate the errors which may occur in using site-index curves to classify young stands on areas different from those for which site-index curves were constructed. Observation and study of over 100 plantations on prairie soil throughout Illinois show that conifers in general follow the same growth pattern, while native hardwoods follow closely that of the normal plantations on which the site indexes were based.

65. DESCRIPTION OF GROWING STOCK

[647]. 65 : 04.5. UGGLAS, C. AF. Hur skogen växer. Något om jämförande beståndsfotografering. **[How the forest grows. A note on comparative photographs of stand development.]** *Svenska SkogsvFören. Tidskr.* 45 (2), 1947 (132–43). [Sw.]

The author urges the utility of comparative photographs taken from the same spot (marked with post, and stones) and angle (compass reading) to illustrate the history of stands. He describes briefly his own efforts with this method and appends 16 pairs of his photographs with annotations. The difficulties are those of work and expense, which probably make the method out of the question for individual private forest owners. Taken at regular (say 5-year) intervals, such photographs should, however, be very valuable records for research institutions and the like.

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

[648]. 66 (485) : 98.1. PETTERSON, H. Avverkningsberäkningar för övre och mellersta Norrland. **[Cutting budgets calculated for Upper and Middle Norrland.]** *Medd. SkogsforsknInst., Stockh.* 36 (2), 1947. pp. 29. [Sw.e.]

An attempt is made to estimate the quantities of sawtimber and pulpwood that can be cut in the region over a period of 40 years. Results are discussed and tabulated by conventional groupings of river catchment regions. It is hoped to deal in a future publication with the methods used.

[649]. 66 : 22.14.1 : 62. LEROY, R. Des divers modes d'assiette des coupes et de fixation de la possibilité dans les futaies jardinées. **[Different methods of locating felling sections and fixing possibility in selection forest.]** *Bull. Soc. for. Franche-Comté* 24 (16), 1947 (18–29). [F.]

In managed selection forest the location of felling sections and the fixing of possibility are regulated either by area or by volume. The author compares the two methods and concludes that when carefully applied in a well managed forest, either is about equally effective. In the case of mismanagement, the dangers of the two methods are different, and it is suggested that they can best be avoided by mixed methods based in the first place on regulation by area, but temporarily applying regulation by volume if at any time the actual volumes realized are too far removed from those estimated. The volumes realized in each year, and the total volumes realized from the beginning of the rotation, must be checked each year against the estimated amount. Formulas are given for determining when the divergence is sufficiently great to make the application of regulation by volume necessary, and conversely when it is safe to return to regulation by area. The permissible degree of divergence is fixed at 25 per cent.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

73. RATE OF INTEREST

[650]. 73. TAYLOR, W. L. **A problem of forest finance.** *Forestry* 20, 1947 (3–6).

The writer argues against the continued employment of compound interest when practically all analogous undertakings (e.g. the railways) are free of it. The forester performs a function, the advantages of which go far beyond the establishment of forests for the cash value of the crop. The value of these additional services (e.g. security, employment, compulsory saving, amenity, soil protection, water conservation) is no less real because it is deferred and in part untouchable in terms of ready money.

[651]. 73 : 60.2 : 63. STOFFELS, A. Het rendement van beplantingen langs wegen en weilanden. [**The financial yield of roadside and pasture-side plantations.**] *Ned. Boschb.-Tijdschr.* 15 (12), 1942 (610–4). [Du.]

The formula used is:

$$c \times 1{\cdot}0\, p^t + (g + b)\,\frac{1{\cdot}0\, p^t - 1}{1{\cdot}0\, p - 1} = \mathrm{E}$$

where c = cost of plants and planting, p = rate of interest, t = rotation, b = average annual tending costs, g = value of detriment to neighbouring land, canals, etc., due to the presence of trees, and E = net returns from [? = standing value of] the timber. The value of p that satisfies this equation is the rate of interest earned. A graphical method is also shown for determining the rotation of the highest rate of interest if the age/yield curve is known:

74. VALUE OF THE STAND. VALUE OF THE FOREST

[652]. 74.2. LIHTONEN, V. Puuston hakkuuarvosta ja sen määräämisestä. [**The value of the growing stock when felled, and its determination.**] *Acta forestalia fennica* 50 (10), 1942. pp. 30. [Fi.g.]

76. MANAGEMENT STATISTICS

See also *For. Abstr.* 9 (Nos. 196–7, 209, 511, 575).

[653]. 76 : 22.22 : 12.26–8 : 33.6 : 33.55. DURHAM, C. B. **Hazel underwood.** *J. cent. Landowners' Soc.* 26, 1947 (15–18). X.

Hazel underwood now fetches high prices (in England) mainly because it is used for crates for packing pottery for export, owing to the shortage of box boards and cartons. Crate rods are required in four sizes:

20 in a bundle, over 10 ft. long, 1½–2 in. diam. at butt.
40 „ „ „ over 12 ft. long, 1–1½ in. „ „ „
75 „ „ „ 10–12 ft. long, ½–1 in. „ „ „
100 „ „ „ 7–9 ft. long, ½ in. or less „ „ „

The rods are sold by the load of about 4 tons. The price to be derived from an acre of Hazel is about £63 10s. on a yield of 250 bundles of crate rods (£50), 200 bundles pea sticks (£6), 25 bundles of bean rods (£2 10s.), and clothes props, crate heads, etc. (£5). The cost of production per acre is: cutting, sorting and tying 250 bundles, £18 15s., bundling pea sticks, £2 10s., bundling bean rods, £1 5s., sundries £1 10s. If as much as £22 10s. is paid for an acre of underwood, this leaves a profit of £17 per acre.

[654]. 76 : 94.3 (47.1) : 97.2. PIHA, A. Maatilametsälöiden liikejäämä ja sen rakenne. [**The business surplus of Finnish estate and farm forests and its structure.**] *Acta forestalia fennica* 49 (5) (1941), 1942. pp. 348. [Fi.g.]

[655]. 76.1 : 82 (410). MACGREGOR, J. J. **Labour costs in English forestry since 1824.** *Forestry* 20, 1947 (30–43).

8. FOREST ADMINISTRATION

81. ORGANIZATION. REGULATION OF SERVICE

See also *For. Abstr.* 9 (Nos. 37–40).

[656]. 81 (45). FASSATI, G. I. Sulla organizzazione del corpo forestale dello stato. [**The organization of the state forestry service.**] *Ital. for. mont.* 1 (3), 1946 (94–9) [It.]

The reorganization of the Italian Forest Service raises two questions of principle: (1) is the practice of forestry to remain, as in the past, practically a state monopoly? (2) is the Forestry Service to continue to be

organized as a semi-military body? The writer considers that it is of the greatest importance that higher forestry education should be available for private practitioners as well as state foresters. While the administrative branches of the State Forestry Service should become a civil organization, the executive ranks should continue to be a semi-military organization.

[657]. 81 (73). BREWER, V. W. **Forestry activities of the Federal Government.** Legislative Reference Service, Library of Congress, Washington, D.C. *Public Affairs Bulletin* No. 47, 1946. pp. v + 185.

82. LABOUR QUESTIONS

See also *For. Abstr.* 9 (Nos. 335, 655).

[658]. 82 : 32 : 33.1 : 12.25 (75 : 78). LOWTHER, E. J., and MURRAY, R. V. **Labor requirements in Southern Pine lumber production.** *Sth. Lumberm.* 174 (2182), 1947 (44, 46, 48, 50). [U.S. Bureau of Labor Statistics.]

The Bureau of Labor Statistics of the U.S. Department of Labor has made a study of the labour requirements per 1,000 bd.ft. processed in Southern Pine lumber production, which are now 41·2 man hours compared to 20·7 in 1935. The increase was found to be due to a number of factors, including decreasing average log diameter and increased taper of the average log, the drift of skilled labour towards better paid work, and the growing practice of keeping good workmen on the pay roll in slack periods instead of turning them off as was done formerly. A temporary factor is the current practice in most Southern Pine Mills of processing the hardwoods which occur interspersed with the Pine.

[659]. 82 (485) : 92. WALLNER, O. Förslag till ny arbetarskyddslag och effektivare arbetarskydds-organisation. Redogörelse för förslag, som beröra skogshanteringen. [**Proposals for a new law on and more effective organization for the protection of workers. Report on proposals affecting forestry work.**] *Svenska SkogsvFören. Tidskr.* 45 (1), 1947 (49–56). [Sw.]

[660]. 82 : 33.1. KEOWN, R. McA. **Types and causes of accidents in wood manufacturing.** *Sth. Lumberm.* 174 (2181), 1947 (66, 68, 70).

An analysis of cases of injury dealt with under the Workmen's Compensation Act of Wisconsin during 1945. Forty per cent. of all injuries were caused by being struck by or striking against materials or objects. This type of injury is particularly numerous in woods operations, and proper head protection would prevent or minimize many injuries from falling limbs. Slips and falls in woods operations were the cause of numerous injuries and they also caused 8 per cent. of injuries in wood manufacturing. Hand tools were responsible for about 8 per cent. of all accidents in the industry as a whole, and for 16 per cent. of all accidents in the woods. Vehicles were the cause of 10 per cent. of all injuries in logging operations.

83. FINANCIAL RESERVES

[661]. 83 (494) : 94.1. GONET, C. Les réserves financières de l'économie forestière. [**Financial reserves in forestry.**] *Schweiz. Z. Forstw.* 98 (3), 1947 (111–19). [F.]

Gonet discusses the utility of reserve funds for (*a*) stabilizing annual financial returns, (*b*) meeting emergency expenditure and (*c*) covering new investments and forest improvements in general. Under a special war-time regulation, the creation of such reserve funds from the proceeds of the excess fellings has been obligatory since 1941 in the publicly owned forests of the Canton of Vaud, and the fate of these funds has not yet been decided. Gonet urges that they should not be used for purposes other than forestry, and that the holding of adequate financial reserves should continue to be a legal obligation in the case of public forests.

9. FOREST POLICY

[662]. 9 : 06.2 (92). SOET, F. DE. De wereldpolitiek voor boschbouw en houtproducten opgesteld door de Food and Agriculture Organization van de United Nations en het Boschwezen in Indonesië. [**The 'World Policy for Forestry and Forest Products'**

of FAO and the Forest Service in Indonesia.] *Tectona* 36 (4), 1946 (231–58). [Du.e.]

[663]. 9 : 06.2 : 09.4. HESS, E. Der Wald in der Welt-Organisation der Vereinten Nationen. [**The forest in the world organization of the United Nations [F.A.O.].**] *Schweiz. Z. Forstw.* 98 (2), 1947 (45–67). [G.f.]

90. GENERAL PRINCIPLES OF FOREST POLICY

See also *For. Abstr.* 9
(Nos. 33, 37, 40, 401).

[664]. 90 (54.9). VAHID, S. A. **A note on post-war forest policy for H.E.H. the Nizam's Dominions.** With a foreword by W. V. Grigson. Government Central Press, Hyderabad-Deccan, 1945. pp. v + 38 + plates + map.

The writer has turned into a pamphlet, for public enlightenment, the substance of a lecture given in 1944 [cf. *For. Abstr.* 7 (No. 1546)], adding a section on grazing. The main cause for the almost complete lack of natural regeneration in the reserved forests of Hyderabad-Deccan is unrestricted grazing by some 3½ million sheep. Suggestions are made for increasing the rates of payment in order to discourage grazing in forest reserves and encourage stall feeding.

[665]. 90 (71.3) : 33.32. HOWARD, S. H. **Ontario's Forestry Commission: a report on the public hearings of the Ontario Royal Commission on Forestry, held in Toronto during December.** *Pulp Pap. Mag. Can.* 48 (1), 1947 (87–94, 96, 98, 100).

The hearings reported were mainly devoted to the briefs of the Pulp and Paper Industry of Ontario and the Great Lakes Lumber and Shipping Company and discussion of them, which brings out clearly the cleavage of interest between the two industries.

[666]. 90 (73) : 98.1. WATTS, L. F. **Timber shortage or timber abundance.** *Rep. U.S. For. Serv.* [*1945–*] *1946*, 1946 (1–28).

The Chief of the U.S. Forest Service reviews the general state of timber supply and demand in the United States, and outlines the measures being taken by the Forest Service to try to ensure continual adequate supplies of this vital raw material.

91. SOCIAL AND ECONOMIC INFLUENCE OF THE FOREST. NATIONAL PARKS. RESERVES. FOREST INFLUENCES

See also *For. Abstr.* 9
(Nos. 46, 78–80).

[667]. 91.6. BURKILL, I. H. **On the dispersal of the plants most intimate to Buddhism.** *J. Arnold Arbor.* 27 (4), 1946 (327–39).

Special reference is made to the Sacred Lotus (*Nelumbium nelumbo*), *Ficus religiosa*, *Shorea robusta*, *Saraca indica* and *Ixora coccinea*.

[668]. 91.6 (59.3) : 94.31 : 12.26–8. RAPPARD, F. W. Korte aanteekeningen over tempelbosschen in Siam. (Voornamelijk aanplant van *Dipterocarpus* spp.). [**Brief notes on temple groves in Siam (chiefly plantings of *Dipterocarpus* spp.).**] *Tectona* 36 (7/8), 1946 (363–6). [Du.e.]

Brief notes are made on the *Dipterocarpus alatus* groves of Bangkok and similar groves of a related species at Chumphen. Scarcely a temple in the Siam plains is without a plantation in the vicinity. In the Koeènoy basin these consist of other species also—Teak and other timber trees, and fruit trees or Palms. Useful species are also grown round schools, customs offices, etc. *Dipterocarpus* spp. are planted as roadside trees, in small woods of about ½ ha., on estates and in villages. In the last case the oil used for torches is an important by-product, whereas in temple groves only the wood is used.

Reference is also made to evidence of Buddhist influence in the former temple groves of Teak and other useful species in Java, and the sacred forest of *Dipterocarpus* still existing on Bali. In central Java a native freshwater turtle is still preserved as a sacred animal.

92. FOREST LAW

See also *For. Abstr.* 9
(Nos. 503, 659, 677–9).

[669]. 92 (410). GREAT BRITAIN. **Forestry Bill: read a second time.** *Parliamentary Debates (Hansard): House of Commons off. Rep.* 433 (51), 1947 (1199–1242).

[670]. 92 (410). ADKIN, B. W. **Trees adjacent to highways. Kent *v.* Marquis of Bristol.** *Quart. J. For.* 47 (1), 1947 (23–5).

Notes on a case heard in 1940, in which the landowner was mulcted in damages to the widow of a man killed by a tree falling on to the road. It was held that since the defect in the tree was apparent (a large cavity in the butt) and could have been further examined to ascertain if the tree was safe, the owner was guilty of negligence or lack of care in that he had taken no steps to make it safe. [Cf. *For. Abstr.* 7 (No. 2179)].

[671]. 92 (41.5). **The Forestry Act, 1946.** *Irish For.* 3 (2), 1946 (71–4).

An account of the new Irish Forestry Act, which repeals the Acts of 1919 and 1928. Most of its provisions are a re-enactment of those Acts. Among the new powers granted to the Minister for Lands is that of taking over the management of private forest land on an agency basis. Provision is also made for the granting of temporary rights of way for timber extraction over land adjoining either a State forest property or privately owned woodland, and for the creation of permanent rights of way to serve State forest lands. A new provision enables the Minister to authorize entry on uncultivated land for the purpose of destroying vegetation growing within 150 ft. of a wood, which is a potential fire-danger to the wood, and which the owner of the land fails to remove on receipt of notice in writing from the Minister.

[672]. 92 (489) : 99. THOMSEN, C. L. Træer i Naboforhold. [**The legal position of] trees in relations between neighbours.**] *Dansk Skovforen. Tidsskr.* 32(2), 1947 (63–73). [Dan.dan.] *Repr.* from *Juristen*, 15 Apr., 1944.

[673]. 92 (492) : 35. BEVERSLUIS, J. R. Thans geldende wetgeving en andere algemeene overheidsmaatregelen in Nederland met betrekking tot het bosch en het hout. [**Legislation and other general government regulations now in force in Holland with respect to forests and timber.**] *Ned. Boschb.-Tijdschr.* 17 (4; 5), 1944 (105–19; 141–58). [Du.]

[674]. 92 (494) : 96. SWITZERLAND. Bundesbeschluss betreffend den Ersatz für Waldrodungen und Übernutzungen. (Vom 20. Dezember 1946). **[Federal decree of 20 Dec., 1946, on the restitution to be made for deforestation and excess fellings.]** *Suppl.* to *Schweiz. Z. Forstw.* 98 (1–3), 1947. pp. 4–5. [G.F.]

Provision is made for the issue of supplementary Federal subsidies to promote the replacement of forest cleared for agriculture, and of growing stock removed in excess war-time fellings, in Switzerland. The programme envisaged includes (*a*) afforestation in the mountains and the restoration of protection forests, and (*b*) rehabilitation work in non-protection forests to compensate for the war-time reduction of stocking. For (*a*) the supplementary subsidy may be up to 25 per cent. but the normal and supplementary subsidies together must not exceed 80 per cent. of costs. For (*b*) the Federal Government will contribute, during the next 20 years, up to 25 per cent. of the costs, provided that the Cantons also give an amount equal to at least half the Federal subsidy. Schemes must be approved by the Federal Department of the Interior in order to qualify for these subsidies.

94. FOREST OWNERSHIP.

CO-OPERATIVES

[675]. 94.12 (47.1) : 09.4 : 65 : 76 : 60.31.1. LINNAMIES, O., and RAUTVUORI, E. Suomen kaupunkikuntien metsät. [**The municipal forests of Finland.**] *Acta forestalia fennica* 50 (2) (1941) 1942. pp. 71. [Fi.g.]

[676]. 94.12 (47.1) : 09.4 : 65 : 76 : 60.31.1. RAUTVUORI, E. Suomen kauppalakuntien metsät. [**The forests of the market towns of Finland.**] *Acta forestalia fennica* 50 (4) (1941) 1942. pp. 49. [Fi.g.]

[677]. 94.3 : 92 (4) : 96. SOEST, J. VAN. De voornaamste bepalingen betreffende het particulier boschbezit in het buitenland, in vergelijking met de onze. [**The most important regulations concerning private forests in Europe, compared with those in Holland.**] *Ned. Boschb.-Tijdschr.* 14 (10; 11), 1941 (480–90; 558–67). [Du.]

[678]. 94.3 : 92 (492). SCHIETHART, L. J. Een nieuwe vorm van staatszorg. Enkele opmerkingen naar aanleiding van het Besluit Staatstoezicht op de Bosschen. [**A new form of State supervision. Observations on the Decree [of 17 June 1943] on the State**

Inspection of Forests.] *Ned. Boschb.-Tijdschr.* 17 (6), 1944 (181–5). [Du.]

[679]. 94.3 : 92 (492). SCHIETHART, L. J. Moet het Besluit Staatstoezicht op de Bosschen gehandhaafd blijven? [**Should the Decree on the State Inspection of Forests be maintained?**] *Ned. Boschb.-Tijdschr.* 18 (3), 1946 (60–2). [Du.]

[680]. 94.31 (47.1) : 09.4 : 76 : 65. LAPPI-SEPPÄLÄ, M. Suomen evankelisluterilaisten seurakuntien kirkollisvirkatalojen metsät ja metsätalous. [**Forests and forestry on the parish estates of the Evangelical-Lutheran church in Finland.**] *Acta forestalia fennica* 49 (6) (1940) 1942. pp. 179. [Fi.g.]

[681]. 94.33 (47.1) : 09.4. LIHTONEN, V. Metsäteollisuusyhtiöiden metsistä ja niiden hakkuista. [**The forests of woodworking companies [in Finland] and the fellings carried out in them.**] *Silva fennica* No. 61, 1945. pp. 71. [Fi.e.]

A mainly statistical account, with information on the geographical and economic position of the company forests, site quality, growing stock, increment, and calculated and actual yields, with special reference to war-time felling quotas and fellings.

[682]. 94.34 (47.1) : 97.2 : 76 : 91.8. VIROLAINEN, J. Karjalan kannaksen metsätaloudesta ja sen merkityksestä alueen pienviljelijöiden ansiotaloudessa. [**Forestry on the Karelian isthmus and its importance in the livelihood of the small farmers of this region.**] *Silva fennica* No. 60, 1943. pp. 68. [Fi.g.]

[683]. 94.4 (47.1). METSÄPELTO, E. E. Suomen yhteismetsät. [**Co-operative forests in Finland.**] *Acta forestalia fennica* 49 (1) (1940) 1942. pp. 41. [Fi.g.]

[684]. 94.4 (47.1). WAHLSTRÖM, C.-G. De privata skogsreviren i Finland. [**The 'private forest districts' in Finland.**] *Skogen* 34 (5), 1947 (73–6). [Sw.]

A brief historical account of the 5 'private forest districts'—the only ones of their kind—in the Swedish-speaking region of southern Finland. These are formed by groups of forest owners as co-operatives, both for management and marketing of produce, and each is under the charge of a trained forester appointed by a board of members and paid out of members' annual contributions, which are at present 10 marks per ha. of forest. The number of members varies from 56 to 512, the average forest area per member from 51 to 430 ha. For the 5 'districts' taken together there is a total of 1,147 members owning 95,876 ha. of forest (average 83·6 ha. per member), on which in 1945 fellings amounted to 235,000 cu.m. Much emphasis is given to silviculture and management and since 1934 the 'districts' have received State subsidies, which for 1945 varied between 41,700 and 85,855 marks.

95. FOREST TAXATION

[685]. 95.1 (47.1). Metsäverotuksen uudistamissuunnitelma. [**Plan for reform of forest taxation in Finland.**] *Silva fennica* No. 57, 1942. pp. 129. [Fi.g.]

96. POLICY REGARDING PROTECTION FOREST, DEFORESTATION AND AFFORESTATION

See also *For. Abstr.* 9 (Nos. 46, 70, 674, 690).

[686]. 96 (45) : 60.2 : 60.32 : 23.3 : 11.6. FEDERICO, S. Problemi forestali in Lombardia. [**Forest problems in Lombardy.**] *Ital for. mont.* 1 (5), 1946 (191–214). [It.]

The three main tasks for forestry in Lombardy are (1) to increase and improve the growing of timber in fields, along river banks, etc., on the Lombard plain, (2) the afforestation of the heaths of the hills and plateaux, and (3) to provide better protection for the catchment areas in the mountains, which provide hydroelectric power for industry. The extent of the areas available for these purposes is estimated and some discussion devoted to the suitable species. The author is opposed to the present almost exclusive use of Poplar for planting in the plain.

[687]. 96 (45) : 90. CARULLO, F. I problemi della montagna e delle foreste nel rapporto della commissione economica presentato all'assemblea costituente. [**Mountain and forest problems in the report of the economic committee presented to the [Italian] constituent assembly.**] *Ital. for. mont.* 2 (2), 1947 (85–97). [It.]

A summary and criticism of the report of a committee appointed to investigate and advise on conservation policy and management in mountain and forest areas of Italy. Two specific questions under consideration were (1) the advisability of (*a*) retaining, (*b*) revising the boundaries of, the *zone vincolate* (protection zones), having due regard to the needs of the local population and the exigencies of rational economy and hydrographical protection; (2) the measures that should be taken to ensure the proper management of existing forests, under private, corporate and public ownership, and, if necessary, to increase the area of productive forest.

[688]. 96.5 (45) : 97.1. PAMPALONI, E. Problemi di economia montana in Sardegna. [**Problems of land use in Sardinia.**] *Ital. for. mont.* 1 (5), 1946 (180–90). [It.]

Sardinia, which is a predominantly hilly or mountainous country, much exposed to the action of climatic factors, has only 5 per cent. of its area classified as forest, and much of this small area is very degraded. The historical and economic causes of the progressive deforestation of the island are outlined, and the need for a radical transformation of the predominantly pastoral economy is urged.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

See also *For. Abstr.* 9 (Nos. 70, 184, 523, 654, 688).

[689]. 97 (485). STREYFFERT, T. Förhållandet mellan skogsbruk och jordbruk i den framtida jordbruks-politiken. [**The relations between forestry and agriculture in future agricultural policy in Sweden.**] *Svenska SkogsvFören. Tidskr.* 45 (1), 1947 (1–10). [Sw.]

A lecture devoted mainly to criticism of a proposal of the 1942 Committee on Agriculture in Sweden to supplement small farms in the forest districts with forest acquired, where necessary by expropriation, from estates having more than enough forest. It is claimed that the committee has judged problems of the relation between agriculture and forestry in the general economy almost entirely from the agricultural point of view, and that the most important task is really to secure, in these times of labour shortage, the most effective use of the labour force available in common to these two industries.

[690]. 97.1 (6) : 11.4 : 11.6 : 21.0 : 23.3 : 96.5. HARROY, J.-P. Afrique terre qui meurt. La dégradation des sols africains sous l'influence de la colonisation. [**Africa, a dying land. The degradation of African soils under the influence of colonization.**] Marcel Hayez, Brussels, 1944. pp. x + 558 + map. [F.f.]

The author's aim is to give a comprehensive review of the alarming and accelerating soil degradation which has been taking place all over Africa south of the Sahara during the last hundred years, and which has coincided with the disturbance by European colonization of the delicate equilibrium between climate, soil, vegetation and indigenous systems of agriculture and society. He deals in greater detail with the Belgian Congo, but covers all the principal territories. In addition to about 100 authorities cited in the bibliography (mainly Belgian and English with some German), a great number of others are referred to in footnotes. The work is divided into 7 books, as follows: (1) The formation and maintenance of soils with particular reference to African conditions (69 pages). (2) The degradation of African soils, reviewing the present state of erosion, etc., in the principal territories, one by one (72 pages). (3) The causes of disequilibrium—burning, overstocking, agricultural methods and overcropping (50 pages). (4) The transformation of the native way of life by the colonists; with consideration of the spiritual, material, economic, political and social factors (74 pages). (5) The transformation of African agricultural economy by the colonists (110 pages). (6) The remedies for these evils (125 pages). (7) The application of the remedies (40 pages). The remedies are divided into three degrees (*a*) those directed against the symptoms of the disease, i.e. measures to stop the degradation of the vegetative cover, measures to improve the hydrographic régime, and measures to prevent accelerated erosion and soil degradation. Some 30 pages are devoted to afforestation and reforestation; (*b*) prevention of further injury by improving methods of stock raising and agriculture; (*c*) a complete revision of the

attitude of the Europeans towards the land and the native population.

[691]. 97.1 (91.1) : 12.19.2 : 12.25 : 12.19.4: 23.4. WOLTERSON, J. F. Oude kennis in een nieuw pak. **[Old knowledge in new vessels. —With comment by G. N. Danhof.]** *Tectona* 36 (7/8), 1946 (367–78). [Du.e.]

In the *Agathis* forest region of the Borneo lowlands, the dryland types are: (*a*) Sands with hardpan, poor in bases, composed almost entirely of white quartzite, with a thin, very porous, acid humus layer. Here the two indigenous conifers, *Agathis* and *Dacrydium*, grow, but the finer the sand and the deeper the pan below the soil surface, the greater becomes the admixture of hardwoods in the forest. (*b*) Richer sandy loams with an adequate base status, on which no conifers occur.

The Dyak population recognizes not only these two major types but also the different associations and soil indicator species. Soil texture is judged by the depth to which a pointed stick can be inserted. The poor coniferous sites are too acid for rice and are not farmed, whereas transitional types and those under (*b*) are worked by shifting cultivation, which gives rise to a secondary forest consisting at first of pioneer species and later of Dipterocarps of economic value.

Being unsuitable for agriculture, the *Agathis*/*Dacrydium* forest can be managed as such without detriment to the general economy. On the types where rice-growing is possible, it should be fairly simple to close areas to cultivation until the stage of exploitable Dipterocarp forest is reached, i.e. to work these sites as high forest with natural regeneration in combination with field crops. To stabilize this system it would be necessary to prevent immigration of peoples lacking local knowledge and growing other crop plants on a large scale.

Danhof's comment urges that this is not the way to get Dipterocarp regeneration at low cost. He estimates that in addition to the normal rotation of about 70 years a regeneration period of some 30 years would be needed for adequate Dipterocarp stocking. On the basis of a total rotation period of 100 years, he further calculates that 100 ha. of forest would support only 3 persons, whereas by concentrating upon agriculture and reckoning the soil to be fit for cultivation again in 20 years, 10 persons could live on the same area. The Dyaks might well prove difficult to persuade of the benefits of the former alternative.

FORESTRY THE WORLD OVER

References: 1. *Agronomie tropicale*, Nogent-sur-Marne. 2. *Annual Report of the New Zealand Forestry Service, 1945-6*, Wellington. 3. *Australian Forestry*, Canberra. 4. *Australian Timber Journal*, Sydney. 5. *Biologia*, Washington. 6. *British Columbia Lumberman*, Vancouver. 7. *Chemical Age*, London. 8. *Foreign Commerce Weekly*, Washington. 9. *Nature*, London. 10. *Reader's Digest*, Pleasantville, N.Y. 11. *Southern Lumberman*, Nashville, Tenn. 12. *Tidsskrift for Skogbruk*, Oslo. 13. *Timber of Canada*, Ottawa. 14. *Timber Trades Journal*, London.

The numbers in brackets indicate the reference number and date of publication of the periodicals, etc., to which the annotations refer.

Conferences. An international conference on plant taxonomy and nomenclature (Secretary J. Lanjouw, Botanical Museum, Utrecht) will be held at Utrecht in the summer of 1948 under the auspices of the International Union of Botanical Societies. About 15 botanists are being invited to discuss current nomenclatural and other urgent problems, particularly recent losses of type specimens (**5**; Summer 1947).

Australia. The oldest exotic Pine forest in Tasmania is at Beaconsfield, where 700 acres were planted 20 years ago. The land was not well chosen, the soil being poor and the response disappointing. Yet it is considered that it will prove a profitable operation. Last year some 700,000 ft. of timber was obtained from thinnings and the work is continuing; the timber has a ready sale for box making and other purposes. Some of the trees have made good growth and as much as 560 ft. of timber was cut from one of the largest. Planting was done with a spacing of 6 ft. and thinnings will be continued for some years (**4**; May 1947).

By the Forestry and Timber Bureau Act of 1946 which had effect from September, 1946, the Forestry Bureau with its headquarters in Canberra was reconstituted as the Forestry and Timber Bureau under a Director General, and its functions extended to incorporate the timber planning and co-ordinating responsibilities of Commonwealth Timber Control. The main functions of the Bureau are : (*a*) to provide educational facilities for the training of professional foresters; (*b*) to establish experimental stations; (*c*) to collect statistical data on Australian timber supplies and requirements; (*d*) to advise Government in respect of supply, production and distribution of timber in Australia and its import and export. The Research Division has its headquarters at Canberra, with experimental stations in South Australia and Tasmania which co-operate with the respective State Forest Services, and negotiations are in progress for the establishment of co-operative experimental stations in other States. The Division of Education controls the Australian Forestry School at Westridge, Canberra, which provides a two-years' course of forestry training, following upon a two-years' prescribed course in science at a University (**3**; 1946).

In March 1947 the first general meeting was held of the Australian Pulp and Paper Industry Technical Association, and a draft constitution and rules were unanimously adopted. One of the chief aims of the Association is to promote close co-operation between practical technicians in the industry and researchers of the Forest Products Division of the C.S.I.R. (**4**; May 1947).

Austria. In a recent issue the *Internationaler Holzmarkt* of Vienna reports on the appearance in Austrian coniferous forests of a plague of beetles. Both Fir and Spruce are being severely attacked by the grubs of *Tomicus typographus* and other bark beetles. The warm spring and lack of rain have been exceptionally favourable to the breeding of these pests. It is estimated that 500,000 cu.ft. of Spruce have been killed in Lower Austria alone (**14**; 26.7.47).

Brazil. The new paper mill at Monte Alegre, which will give the country its first important domestic source of newsprint, has entered the experimental stages of newsprint production. The large natural stands of Parana Pine will supply pulp for the mill, and systematic reforestation is expected to ensure reserves of raw material for the future. Recent plantings amount to 2 million trees each of Parana Pine and Eucalypts (**8**; 14.6.47).

Canada. It is announced that the administration of Canada's Forest Products Laboratories is to be decentralized, and that the laboratories at Ottawa, Montreal and Vancouver will in future each report direct to the Dominion Forester rather than through the Ottawa laboratory. The change will be accompanied by increases in appropriations, accommodation and staff. A Forest Research Board composed of representatives of the Dominion Forester's Office and each of the three laboratories will meet to advise the Dominion Forester on policy and research programmes and to make sure that unnecessary duplication of work is avoided (**6**; June 1947).

An examination will be conducted this summer into the growing conditions of the forest in the Alberni district of British Columbia for the purpose of determining site quality and the pathological age of the timber. The data obtained will form a basis for a long-range plan for cutting the standing crop of timber. The general scheme of cutting will be planned for an entire rotation of 100 or more years. The survey will be the application of basic studies conducted by the lessees, Bloedd Stewart & Welch Ltd., in conjunction with the Dominion Division of Forest Pathology. The survey parties will include students from the western universities who will gain valuable practical experience. The result of the survey will be that the areas containing the oldest and most decadent stands will be logged first (**6**; June 1947).

The Knowlton Logging Co., which has obtained a concession for some 100 million ft. of hitherto inaccessible virgin timber in the Ruby Creek area, are just completing the building of a road to open it up. The road skirts the precipitous sides of Ruby Creek at an elevation of about 1,300 ft. above its waters. At one point a way had to be blasted through solid rock for a distance of 1,100 ft. and to a height of 200 ft. above road level. The stand, which is predominantly Fir and Cedar, will be logged at a rate of 1½-2 million ft. a month, using three large Kenworth trucks capable of carrying 18,000-20,000 bd. ft. of timber to the load (**6**; June 1947).

The Ontario Research Committee has authorized the expenditure of $5,000 on an investigation of methods of barking logs and slabwood with a view to increasing the utilization of mill waste for pulpwood. Whilst it may be feasible for large sawmills to install machinery for barking a log before it is sawn, the small mill has to bark its waste in the form of slabwood, and existing slabwood barkers waste 25-50 per cent. of the wood (**13**; April 1947).

Blue grouse have been responsible for a high percentage of mortality of seedlings in nurseries on Vancouver Island, and various repellents have been tried without success. Browsing has now been reduced at least 50 per cent. by spraying the seedlings with yellow paint before planting (**13**; May 1947).

Costa Rica. The Costa Rican Congress has before it a new basic forestry bill, which, if enacted as drawn up, would place an export tax on logs and lumber, institute certain conservation measures and limit concessions on public lands (**8**; 5.7.47).

East Africa. Dr. B. A. Keen has been appointed director of the new East African Agricultural and Forestry Research Organization, which will work in close association with the corresponding Veterinary Organization and the Agricultural Departments of Kenya, Uganda, Tanganyika and Zanzibar (**9**; 9.8.47).

Finland. The furniture industry has developed a new method of manufacturing and packing furniture so as to overcome the handicap of the high freight costs. Wooden (mainly Birch) furniture is made in prefabricated standard parts and tightly packed in cardboard boxes, without surface treatment. The importer put the parts together and finishes the surface before sale (**9**; 3.5.47).

France. It is proposed to establish a national institute of tropical agriculture for purposes of liaison between the various colonial services and research stations of the French empire. It is hoped that it will play a similar rôle to that of the Imperial Agricultural Bureux, particularly in its documentation service (**1**; May-June 1947).

The **Station d'Entomologie agricole coloniale** has recently been established at the Paris Natural History Museum, at 57 Rue Cuvier. The station, which has a large and able staff, is making a thorough study of tropical economic entomology. Special efforts are being made to interest all

concerned with agriculture in the French colonies to send insects. Mailing boxes, government address labels, cards for necessary information, etc., are available for those willing to collaborate (**5**; Summer 1947).

Great Britain. The Composite Wood Section of the Forest Products Research Laboratory at Prince's Risborough is now being equipped with the most up-to-date machinery, including each of the components of a complete plywood factory, which will permit plywood panels up to 5 ft. square to be made. About half of the Section's time is devoted to the study of glues; several thousands of plywood panels have been made using a wide range of glue types, and these are being exposed to the weather over a period of ten years. Infra-red and radio-frequency heating are under investigation, particularly from the aspect of glue-line heating, in which the current is passed along the glue rather than through the wood (**14**; 8.8.47).

There are two large houses near Bettys-y-Coed in North Wales which were roofed 50 years ago with edge-grain shingles of Canadian Red Cedar. These have been periodically inspected and are apparently as good as ever in spite of the heavy rainfall of the district. British Insurance companies charge the same premium for houses with shingled as with tiled or slate roofs (**6**; June 1947).

Mauritius. A batch of *Physonota alutacea* has recently been introduced into Mauritius in the hope that they will eat *l'herbe Condé* (*Cordia machrostachya*) to such an extent that its spread will be checked. This plant was itself accidentally introduced into Mauritius. It is important, however, to note that *Chelymorpha*, closely related to *Physonota*, has at least one species which is capable of eating the sugar-cane plant, and it is in the sugar-cane plantations that *Cordia* has become a nuisance. It is hoped that the introduced *Physonota* will behave as it is expected to do, but warning should be given that it may take a liking to sugar-cane (**9**; 9.8.47).

New Zealand. The aerial patrol provided by the Air Department proved of inestimable value during the Taupo fire emergency. As a result of air observation, many fires were quelled in the incipient stage and it was possible to use fire-fighters and equipment to maximum effect and avoid much more serious losses than were sustained. A forest officer was carried as observer in nearly all cases, information being radioed to headquarters or direct to fire-fighting parties.

An aerial survey of the Taupo district when the emergency was at its height revealed numerous fires burning over a wide area, leaving no doubt that total prohibition of lighting fires out of doors for any purpose whatsoever is necessary under such conditions. Legislative authority to declare a "fire emergency district" in times of high fire hazard now seems an imperative need. The whole position is at present the subject of discussion by interested State Departments (**2**; 1947).

Norway. Last year the Norwegian paper manufacturers allotted 100,000 kr. to the Norwegian Forestry Research Service to be used for the improvement of forest trees (**12**; Feb. 1947).

Surinam. Exports of timber for 1946 are estimated at 32,000 cu.m. compared with an average of about 500 cu.m. during the war years. Demand in the Netherlands for all kinds of timber for reconstruction purposes, and increased U.S. interest in Surinam timber for veneer and plywood have created a market for species which could not be sold profitably before the war. Baboon Wood (*Virola surinamensis*) appears to meet all requirements for veneer and plywood manufacture. It grows on low ground which is swampy during a large part of the year, preventing the use of tractors in getting out the logs. So far, trees have been cut along the edges of small waterways in accessible areas. The chief obstacle to still greater expansion of the industry is this difficulty of extraction (**8**; 19.7.47).

Sweden. Swedish production of tall oil in 1946 amounted to 5,783 metric tons and is still increasing. Export is prohibited because of domestic shortage. Tall oil is used in Sweden chiefly in the manufacture of soft soap and washing powders. Some is employed as a substitute for linseed oil (**8**; 12.7.47).

United States. *Sky and Telescope* for April 1947 contains a note on weather control in connexion with an address by Dr. V. V. Zworykin before the U.S. Institute of Aeronautical Sciences. He pointed out that new electronic calculators will yield rapid results in weather forecasts and that it may be possible to alter the weather by the release of a relatively small amount of energy which will have a "trigger" effect. One method suggested is to spread a large amount of oil on water and then ignite it; the resulting updraught would then change the motions of the higher-level air masses. Another method would utilize solar radiation at "weather control areas" consisting of large areas blackened by carbon deposits. These could easily be changed, when desirable, into highly reflecting areas by the formation of artificial fogs (**9**; 16.8.47).

Plans for developing the National Arboretum at Washington, D.C. (established in 1927) have been recommended to the Secretary of Agriculture by the National Arboretum Advisory Council. Under these the Arboretum would become "a great library of living plants" for use by students and plant scientists throughout the world. So far only preliminary development work has been done at the Arboretum except for the planting of young, rare plants collected from all over the world (**5**; Summer 1947).

The use of "wet" water promises a great advance in fire fighting. Wet water is water to which a chemical wetting agent has been added in order to increase its penetrating action by reducing the surface tension. Wetting agents were developed originally for the textile industry and several hundred formulas are now on the market. Not all are suitable for fighting fire, but about 30 so far tested show promise. The first firm to concentrate on the fire market is Arnold Hoffman & Co., of Providence, R.I., with its "Drench" which was put on the market in November, 1946. The present price is $2·50 per gallon in 55-gallon drums. The standard concentration for Class A fires (wood, rubbish, etc.) is one per cent. of wetting agent in water. For volatile oils with flash points over 100°, a two per cent. solution gives maximum efficiency but good results have been obtained with lower concentrations.

Petrol and other low flash-point liquids do not respond satisfactorily to wet water. As no galvanized container can for long resist the action of a wetting agent, this should be added to the water just before use. On steel tanks the effect of a wetting agent with a good rust inhibitor is no worse than that of plain water. The Massachusetts Forestry Department's patrol trucks now carry wet water. The Rhode Island Division of Forests and Parks recently tested a wetting agent against plain water in an actual woods fire on an area covered by thick litter, Pine needles and dead, dry brush. Two crews of equal numbers of men, using the same type of equipment, attacked different parts of the fire with wet water and plain water respectively. The plain-water crew took 5 hours to stop their fire, re-wet their lines and overhaul. The wet water crew killed their acres of fire in less than an hour and there was no need for re-wetting or all-night patrol (**10**; April 1947).

A study of the factors influencing wood decay under the conditions of modern construction has been initiated by the New York State College of Forestry at Syracuse University and will be carried out with the collaboration of architects, contractors and builders of New York State. The project will include the study of wood decay in permanent dwellings, summer bungalows, storage plants, office and industrial buildings, and other types of wooden structure. Heavy demand for timber during the last few years has brought inferior grades of timber on to the market and even some of the better grades are poorly seasoned. New methods of building and insulation, and the use of laminated and plywood are steadily increasing. The combination of these circumstances has led to an increase in decay of building timbers (**11**; 1.7.47).

The arrival on the American market of a new, one-man, high-cycle electric chain saw is reported. It is claimed that his saw, which weighs only 27 lb. complete, can be easily handled by one man for felling, limbing and cross-cutting trees, or for accurately cutting timbers up to 20 in. Operator fatigue is said to be greatly reduced by elimination of the weight, vibration, engine-heat and exhaust fumes encountered in direct engine saws. The electric power is furnished by an integral petrol engine—a compact light-weight generator which can be carried to any location and can also be used to operate other types of high-cycle electric tools such as drills, nut runners, or grinders (**14**; 5.7.47).

U.S.S.R. In the latest five-year plan, the Chief of the Central Administration of the Wood Chemical Industry of the U.S.S.R. envisages intensive development of wood chemistry in Russia.

Wood-tar residue has become a basic ingredient for the manufacture of many chemicals in Russia and wood-tar oil is stated to be excellent for stabilizing petrol produced by cracking. Pitch has replaced starch and molasses as a binder for moulds at many foundries. Pyrocatechin is said to provide a most suitable material for dyeing furs black. Bearings of impregnated wood are said to be more durable than bronze bearings and to be particularly suitable for under-water applications (7; 14.9.46).

Western Europe. The Timber Sub-committee of the Emergency Economic Committee for Europe estimates that the softwood lumber requirements of the United Kingdom, Belgium, the Netherlands, France, Denmark and Switzerland for 1947 total 7,342,000,000 ft. These countries will have a supply of only about 5,002,000,000 ft., of which 1,802,000,000 ft. will come from indigenous production and the remainder from imports. In other words, the 1947 supply will be only about 70 per cent. of stated requirements, which in turn are less than one half of normal pre-war consumption (8; 5.7.47).